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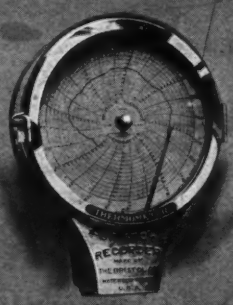

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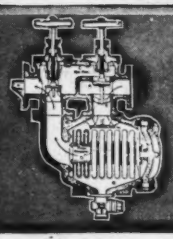

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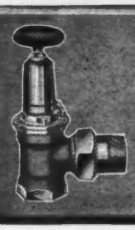

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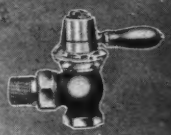

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THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK NOVEMBER, 1916

What Can Best Be Done to Advance the Interests of the Engineering Profession in the United States?

By J. A. L. WADDELL.

From an address before the Engineers' Society of Western Pennsylvania, July, 1916.*

It will be well to summarize the undesirable conditions and the alleged deficiencies in the general make-up of American engineers. Those most commonly recognized or claimed are the following:

A. The importance of the engineering profession is not at all adequately recognized by the general public.

B. Engineers as a class are not paid enough for their services.

C. Engineers are not sufficiently often appointed to high executive positions for which their special training and knowledge eminently fit them.

D. In most joint work where a lawyer and an engineer are employed, the lawyer is usually given the leading part and the greater compensation, and the engineer is forced to fill a subordinate position with small pay.

E. Engineers do not take a proper interest in politics; and hence are not given any of the political plums, these going generally to the lawyers and the business men.

F. Engineers are too modest for their own good, hence their great works are comparatively unknown outside of the technical world—and often none too well within it.

G. Engineers as a class are lacking in the ability to speak readily and convincingly in public, and hence cannot influence the masses or guide their efforts towards the accomplishment of important *desiderata*.

H. Engineers are trained too closely along narrow mathematical and technical lines and not in those which develop them broadly as men and as citizens.

I. Engineers, as a class, do not pay sufficient attention to the proprieties, do not dress with sufficient care, do not have sufficient dignity, and rather look down upon a man who concerns himself seriously with such matters of minor importance as personal appearance and the general requirements and trifling obligations of society.

J. American engineers, as a rule, have not a thorough command of their native language in either writing or speaking, owing mainly to the fact that they have been taught to look upon language-study as of far less importance than mathematics or technics.

K. American engineers, because of their narrow training, are not interesting members of society, in that they are unable to converse well upon general subjects, and because they are not keen in regard to any matter that lies without the pale of their professional life.

L. There is lack of ambition and ear-

*Pp. 467-564 of the Proceedings.

nestness among the rank and file of the engineering profession, making them content with earning their comparatively small monthly wage and with living a hum-drum life, and preventing them from advancing beyond mediocrity.

M. There is as yet no adequate general code of ethics established for engineers; and for that reason the profession cannot stand as high in public estimation as the other professions which have such established codes.

N. There is a lack of harmony among engineers as a body (due possibly to the need of a proper code of ethics, but probably also to a number of other important reasons) which tends to hold back the progress of the profession.

O. The field of activity of the American engineer is too restricted—both from a business standpoint and geographically.

What follows will deal essentially with the remedies for the existing difficulties, defects and general indesirabilities connected with our profession and with the manner in which the interests of American engineering may best be advanced. This subject involves two underlying questions:

First: What are the interests of the profession? and,

Second: What is the limit of their advancement?

Fundamentally, the interests of the profession are inseparably linked with those larger interests of the public which are paramount for the progress of mankind; consequently, it may be stated, without fear of contradiction, that the status of engineering can be improved mainly in one way, viz., by increasing its usefulness to humanity. This object is the true *raison d'etre* of the profession, hence the augmenting of its effectiveness will certainly react favorably upon the aggrandizement of its appreciation by the general public.

The amassing and the consumption of wealth by the people constitute the most important factor in the process of attaining the maximum of material satisfaction for both the individual and the community, which satisfaction is the true measure of national progress; and this can be secured only by a continuous and progressive development of the country's resources. With such development the engineer is directly concerned and he is responsible in a large measure for that development. This, in a broad sense, is the service that he renders to mankind. A keener appreciation by the general public of the engineer's real function in society is greatly to be desired; and its accomplishment constitutes the first effective step to be taken in advancing materially the interests of the profession. This is the psychological phase of the problem. A proper recognition is essential so that adequate compensation may follow.

In order that the engineer's efficiency may increase and that he may be able to respond to the growing needs of a highly complicated society it is necessary that there be a continual growth in professional knowledge to enable him to meet such demands. Again, to render it more certain that a proper compensation will be the reward of the engineering profession, it is desirable that the supply of engineers be fairly well adjusted to the average rate of development of the country so that no large surplus will be forced into competitive methods for obtaining business. A proper balance should be maintained, between the number of engineers of all lines and the total amount of capital available from time to time for investment.

We thus see that the engineering profession is especially interested in securing:

1. Proper recognition.
2. Adequate compensation.
3. Increase of professional knowledge.
4. Proper balance or adjustment of various classes and numbers of engineers to meet the needs of a developing country.

To secure greater recognition requires that a more extended publicity be given to the works of engineers and to the results and effects thereof upon the community in which those works exist. It is not sufficient merely to describe the technical details of a structure or other piece of construction work, but it should be shown how such a structure or construction affects the community by drawing a sharp contrast between the conditions preceding the improvements and those

subsequent thereto. It is this that the public can best understand and appreciate.

The life of an engineer may be divided into three epochs: First, from boyhood up to the time of graduation from the technical school; second, as a young engineer in practice while earning his spurs in the profession, say, on the average, for fifteen years, and third, thereafter as an expert in his line of specialization. As the only truth effective way to improve the status of the engineering profession is to augment the efficiency and increase the capacity of the members of which it is composed it will be pertinent to discuss what should be done both for and by the members during each of the three said epochs.

FIRST EPOCH.

The student portion of an engineer's career is by far the best time of his life to produce upon him lasting impressions that will benefit him later professionally and thus tend to aid the profession itself by increasing his efficiency. Unfortunately, it is difficult to get hold of and do anything for the embryo engineer before he enters the technical school, because boys often do not make choice of their calling until they are about ready for college life, and some of them not even then.

The improvements necessary for engineering courses in general in order to increase the efficiency of the students as much as practicable, arranged in the order of their importance, in the speaker's opinion, are as follows:

1. Extending the duration of the course from four to at least five, and, preferably, six years; or else the establishment of separate schools for post-graduate engineering work of all kinds.

2. Arousing the enthusiasm of the entering freshman in respect to the profession of engineer, showing them its grandeur and its usefulness to mankind.

3. Inculcation of a love of study and work for their own sake and not mainly because of the money that can be earned thereby.

4. Instruction as to how best to study so as to save time and labor, or in other words, the economics of mental effort.

5. A thorough, elaborate and systematic study of sound business-English, extended over each year of the entire duration of the course.

6. A general broadening of the course of study so as to include thorough instruction in such important lines as economics, history, oratory and business.

7. Making the study of the Spanish language obligatory, and that of any other foreign modern language optional.

8. Improving fundamentally the study of all foreign languages, so that upon graduation all the students thereof shall be able to read, write and speak them fluently, correctly and gracefully.

9. Study of the art of systemization and its application to all lines of activity.

10. Teaching of ethics for engineers.

11. Accumulation of individual libraries, and showing how to utilize them properly.

12. Establishment of better opportunities for acquiring individual scholastic distinction by the students.

In order that technical education may keep pace with engineering progress, one of two things must be done—either the engineering curricula in the universities and technical schools must be lengthened or else they must be modified so as to cut out some of the more advanced courses, in order to permit of more thorough instruction in the remaining ones and of the addition of many culture studies, leaving those students who desire more complete technical education to obtain it in post-graduate engineering schools. In any case, we certainly need more post-graduate technical courses than are now available for the youth of the United States.

On the other hand, the number of trade schools should be increased so as to provide practical education for artisans, draftsmen and the lower-grade engineers who have not the desire nor the means to take a full technical course.

Too much cannot be said about the ultra-importance to all American engineering students of a thorough command of their native language. Without it their success as engineers is almost sure to be mediocre—or worse. In every year of the entire curriculum there should be courses in the study of English, and in

the technical courses themselves the professors should insist upon the employment of good English by all the students in reading, writing and speaking.

For many years the speaker has advocated the obligatory study of the Spanish language in all the technical courses of instruction given in the United States; and since the advent of the present war he has been harping on the subject continually. Our country is destined ultimately to dominate the trade of the Latin-American countries; and the present is the opportune time for the speedy accomplishment of this object.

Much of an engineer's success depends upon the size and character of the technical library which he accumulates. No one can do great work in any profession without having at hand a reference library. This fact should be driven into the minds of all technical students at the beginning of the course of instruction, and they should be reminded of it from time to time by the members of the faculty. It should be considered a deep disgrace for any student to sell a text book after he has finished the course of instruction in which it was employed. If he does so, he is very liable to regret it for many a year. No books can quite take the place of those which one uses at college, even if much better treatises are later available.

SECOND EPOCH.

We shall now pass to the consideration of what can best be done by young engineers in order to advance the interests of the profession. The possibilities may be listed as follows:

1. Continuing study after graduation.
2. Buying books and collecting data.
3. Post-graduate work at some leading technical school, and obtaining of advanced degrees.
4. Joining technical societies.
5. Systemization of work.
6. Adherence to professional ethics.
7. Setting an ultimate goal to attain.
8. Writing technical papers and books.
9. Publicity of achievement.
10. Helpfulness to others.
11. Becoming a useful citizen, attaining prominence in the community, and keeping abreast of the times.

Every practicing engineer should purchase, as fast as they are issued, the various good engineering books, covering the lines in which he is specially interested, no matter how great may be the expense involved. A professional man can get along better without food than without books. He may not have time to read the entire contents of all that he purchases, but he should at least look them over so as to acquaint himself with their field and be able to refer to them when the necessity for so doing arises. A good serviceable technical library is certainly a most important asset for every practicing engineer.

POST-GRADUATE COURSE.

Sometimes there comes to a young engineer, after he has been in practice a few years, an opportunity to take a post-graduate course; and he is truly a lucky man who encounters such an opportunity.

Every engineering alumnus, just as soon as he receives his diploma, should hasten to join (in the lowest grade, of course) the national technical society most directly connected with his line of work; and if there be a local engineering society in the place where he resides, he should join that also. Through the national society he will come into touch with the great engineering problems of the times, and will make the acquaintance of many of the leaders in the profession, provided that he attends the annual meetings and conventions and, if practicable, the regular bi-monthly meetings also; and through the local society he will become interested in state and municipal questions involving engineering, all of which results are greatly to be desired. He should take as active a part as practicable in the affiairs of his technical societies, and should make his services useful and appreciated.

The young engineer should adhere as closely as he can to the ethics of the profession; and, especially, he should avoid subjecting himself to the slightest suspicion of dishonesty or even sharp practice of any kind. An engineer's reputation is as delicate as a woman's, and if it be once really besmirched, it will be found next to impossible to rehabilitate it. The good things that a man does are

often very quickly forgotten, but the bad ones are long remembered.

TECHNICAL WRITING.

Nothing will help a young engineer more than the writing and publishing of good technical papers and books, and nothing, except dishonesty, will injure his reputation more than issuing poor ones. Within a year or two after graduation an engineer can properly begin upon a small scale to write technical papers, provided that either he has something new of his own to tell, or that he collects and digests data of real value to the profession that have not previously been adequately compiled; but he should have a number of years of experience before attempting to write a book.

THIRD EPOCH.

We shall now pass to the last division of the subject of this address, viz., what can best be done by the old, established engineers to benefit the profession; and as in the two preceding cases we shall list the possibilities as follows, recording them this time, as nearly as may be, in the order of their importance:

1. The establishment of an American Academy of Engineers.
2. Distinctions and rewards for effective and important services.
3. Acting as advisors to the American Government.
4. Aiding to pass proposed legislation that is favorable to the engineering profession and to prevent all that is unfavorable thereto.
5. Establishment of a clearing house for the employment of young engineers as well as of older ones of minor grade.
6. Improving engineering education.
7. Improving engineering literature.
8. Bringing engineers into closer touch with capitalists.
9. Securing for American engineers important appointments in foreign countries.
10. Placing road-building under the control of engineers.
11. Placing city planning in the hands of engineers.
12. Placing municipal management under the jurisdiction of engineers.

Comment is now in order concerning each of these listed possibilities.

It has long been recognized and often remarked, in both conversation and print, that none of the American technical societies fulfill all the functions of which they might be made capable. Each society falls short of certain of its possibilities of achievement and usefulness.

One of the essentials in which the national engineering societies fail is ethics. They have no adequate code therefor, and they make no systematic effort to enforce what little ethics they recognize, generally refusing to settle disputes among the members anent important matters of disagreement. A court of last appeal is certainly needed by the engineering profession.

Again, the national societies have not in the past made a practice of taking an active part in national and state legislation concerning matters of importance to the engineering profession, as certainly was their duty; nor have they caused their influence to be sufficiently felt at Washington in an advisory capacity in connection with important problems involving engineering.

Recognizing the necessity for a national engineering association of the highest possible standing, to be governed almost entirely by altruistic motives, and devoted to the advancement of both the engineering profession and the nation itself, certain engineers about the end of 1909 made a systematic endeavor to establish an American Academy of Engineers. The attempt was not a success at that time, but the idea of establishing the Academy has by no means been abandoned, for there may be started at any time a move to revive the project.

DISCUSSION.

SAMUEL E. DUFF: I want to take up for discussion one phase of Dr. Waddell's paper which appealed to me. I refer to the organization of the American Academy of Engineers. There are some things in Dr. Waddell's reference to it which appear to me to be particularly important for discussion.

I notice that membership in the Academy is to be restricted to members of what are called the National Engineering Societies.

It seems to me that the organization of engineering societies in this country is

fundamentally wrong, and for one particular reason; viz., the National Engineering Societies of this country are divided into societies largely of specialists. I think that principle is fundamentally wrong.

If we are ever going to reach a National Academy of Engineers, I rather believe the probability of the structure of the Academy being carried out along the lines on which this Society is organized and managed, viz., all branches of engineering combined on practically an equal footing as far as the membership and management are concerned.

We have in our society sections for the discussion of the separate branches of engineering, each particular branch in its own way. We are not able to carry that out, possibly, as extensively as we will later. In other words, sometimes the discussion before the structural section of the society may not be restricted to structures only, and the same way in the mechanical section, a subject possibly not restricted to mechanical engineering may be discussed.

But in the majority of cases, each section takes up its own work.

It seems to me perfectly feasible to organize in the United States a series of local societies similar to the Engineers' Society of Western Pennsylvania, working on their own local and definite problems, with which they are extremely familiar. It is also possible to fix the qualification for full membership in these societies by some national convention or other means for national agreement, and it is also possible to set the standards of ethics of the profession by similar national agreement, leaving the local societies to manage their own social affairs and their business affairs in a large degree by themselves.

One other point that I want to speak of in Dr. Waddell's paper is the length of time a student should remain in an engineering school—the six years that he speaks of. This is something I have no right to talk on because I am not an educator, but it seems to me that one of the difficulties we have today is that a great many of the younger engineers go to school too long in the sense that they follow too long a multiplicity of detail in engineering education without the practical experience. I have had a little experience with some graduates of schools who are filled full of such a mass of detail that some of them have forgotten the fundamental principles, and if you happen to get on the line that they think they are going to be specialists in, they will bore you to death with a lot of infinitesimal detail that the practicing engineer, who has to satisfy capitalists and get something done, hasn't any time to listen to. I think one can go to school too long. I think that Dr. Waddell's suggestion of an engineering course of six years should be modified to some extent so that practical work is taken up some time during that course. I think the great defect the engineering graduate has to overcome is that he has not had any definite connection with commercialism, or business, or the fact that everything must be done at a profit—he lacks the connection between that fact and his technical education.

GARDNER S. WILLIAMS: Referring to the suggestions upon the education of the engineer, the writer heartily endorses the first six. As to the seventh and eighth, making the study of Spanish obligatory, and providing a speaking knowledge of foreign languages, he is very much in doubt. The value of a foreign language lies not alone in the ability to speak it, which latter is ordinarily of purely commercial use. The literatures of France and Germany are a thousand times more valuable to the engineer than is that of Spain, and should be within the grasp of every consulting or designing engineer. For the field man or superintendent of construction they may be of less or perhaps little consequence, and so is Spanish, unless he be brought into contact with Spanish speaking peoples. It therefore seems that the acquisition of a reading knowledge of French and German is of more value to the engineer than is a speaking knowledge of either or of Spanish alone. While it is quite true that much business will be done with South and Central American countries, after all is said and done, only a comparatively few engineers will go there to do it. To the writer's mind the greatest value of the study of a foreign language is in the training it gives in the use of one's own.

In no other way can the proper and distinctive use of English words be so well taught as in the translation of a foreign tongue, and in this particular the Latin language excels all others that have come within the writers' experience.

Dr. T. A. L. Waddell: Concerning the proper duration for engineering courses, I am firmly of the opinion that the time has come to make a fundamental change. I believe that one of these two schemes will have to be followed: Either all first-class engineering courses will have to be extended from four years' to five years' duration, with eleven working months to the year for the students; or else the lower-grade students will have to attend trade schools, the present purely technical four-year courses will have to be curtailed by omitting most of their so-called practical features in order to allow time for more theory, better drill in the fundamentals, and a large increase in cultural studies, and the really fine students who have the ambition to advance beyond the rank and file of their fellows will have to go for one, two, or even three years to post-graduate schools of engineering, where they can be taught all that is generally known to the profession in its various branches. As young Americans are eager to get into harness as quickly as possible and cannot, except in a few cases, be persuaded to devote more than four years to the obtaining of a technical education, it is probable that the second scheme will have to be followed. Should we jog along as we have been doing and give only four-year engineering courses, we shall assuredly drop behind the technical men of Europe—which would be a national calamity.

To Gardner S. Williams' objection to the study of Spanish instead of French, German, or Latin, the author would reply that, in his opinion, the time is coming when quite a large proportion of the technical graduates of the United States will do business in Latin-American countries; and that whether the said time is to be close at hand or distant, depends upon how soon and how thoroughly the Spanish language is taught in this country, not only in the technical schools but also in the high schools and other institutions of learning of minor grade. Mr. Williams agrees with the author that the study of some foreign language is essential for a proper understanding of one's mother tongue, but he believes that either French or German would prove more serviceable than Spanish and that Latin gives the best training of all. The author cannot agree with these views; for his personal experience has proved that a knowledge of French is mainly a gentlemanly accomplishment; and the experiences of many of his friends show that German is of practical use in this country mainly to the pure scientists and only occasionally to practicing engineers. The reason why Latin has proved to be the most serviceable foreign language for training is its almost exclusive use for that purpose in the preparatory schools. Any modern language, however, would be just as effective as the Latin. In this respect he believes that there is no difference in value between French, German, and Spanish.

Newly Collected Data on Heating and Ventilation

By EDWARD B. JOHNSON

(Presented before the Municipal Engineers' Society of New York, as a discussion of the paper by Frank G. McCann, read before that society and presented in THE HEATING AND VENTILATING MAGAZINE *for September,* 1916.)

Experience with the engineers of the New York City departments has indicated a desire for easily accessible data on the subject of the design of heating systems for public buildings and homes. In the following notes have been collected data from a number of sources, with an explanation of their use.

The heat emitted by a radiator in a room should naturally supply the loss of heat from that room. This loss may be considered as due to three causes: that through the glass surface, that through the exposed walls, and the heat required to warm the cold air leaking in or admitted to the room for ventilation. If

TABLE 1—HEAT LOSSES THROUGH BUILDING MATERIALS.

Materials		Heat Units per Degree Difference per Square Foot								Total Loss B. T. U. per Square Foot for Total Differences of Temperature Between the Inside and Outside—Degrees			
Substance	Construction	Peclet carp'n	Germ. Gov't	Aust. Gov't Mac.	Green 1913	Reck. and Reit.	Carlt. F. Tw'd	Harding	Hoffman	Average	60	70	80	90
Glass	*Single window	....	1.09	1.07	0.96	1.03	....	....	1.0	1.02	61	71	81	91
	*Single window (wet)	....	....	....	1.1	....	....	....	....	....	..	..	..	..
	*(Wire glass) single window	....	....	1.04	....	....	1.35	....	....	....	..	..	..	..
	Double windows	....	0.418	0.47	0.41	0.472	0.50	....	0.6	0.48	29	34	38	43
	Single skylight	....	1.118	1.14	1.06	1.090	1.10	....	1.1	1.10	66	77	88	99
	Double skylight	....	0.621	0.48	0.51	0.492	0.60	....	0.7	0.57	34	40	44	51
Brick	Wall, 8 inches thick	0.37	0.46	....	0.39	0.37	0.39	....	0.4	0.40	24	28	32	36
	Wall, 12 inches thick	0.32	0.32	....	0.31	0.29	0.31	....	0.31	0.31	19	22	25	28
	Wall, 16 inches thick	0.28	0.26	....	0.25	0.25	0.25	....	0.26	0.26	16	18	21	23
	Wall, 20 inches thick	0.25	0.23	....	0.21	0.22	0.21	....	0.23	0.22	13	15	18	20
	Wall, 24 inches thick	0.24	0.20	....	0.18	0.19	0.18	....	0.21	0.20	12	14	16	18
	Wall, 28 inches thick	0.22	0.174	....	0.16	0.16	0.16	....	0.19	0.177	11	12	14	16
	Wall, 32 inches thick	0.21	0.15	....	0.15	0.14	0.15	....	0.17	0.16	10	11	13	15
Brick and plaster	8½ inches thick	....	....	0.43	0.37	0.36	....	0.5	....	0.27	16	19	22	25
	13 inches thick	....	....	0.34	0.29	0.28	....	0.33	....	0.31	19	22	25	28
	17½ inches thick	....	....	0.29	0.24	0.24	....	0.25	....	0.25	15	18	20	22
	22 inches thick	....	....	0.24	0.21	0.21	....	0.21	....	0.22	13	15	18	23
	27½ inches thick	....	....	0.21	0.18	0.18	....	0.17	....	0.19	11	14	16	18
Brick furred and plastered	8½ inches thick	....	....	....	0.24	....	0.24	0.41	0.28	0.29	17	21	24	27
	13 inches thick	....	....	....	0.20	....	0.20	0.3	0.217	0.229	14	16	19	21
	17½ inches thick	....	....	....	0.18	....	0.18	0.23	0.18	0.19	11	14	16	18
	22 inches thick	....	....	..	0.16	....	0.16	0.2	0.161	0.17	10	12	14	16
	26½ inches thick	....	....	....	0.14	....	0.14	0.16	0.147	0.147	9	11	12	14
Limestone	Wall, 16 inches thick	....	....	0.56	....	0.43	....	....	0.39	0.46	28	32	37	41
	Wall, 20 inches thick	....	....	0.50	....	0.38	....	....	0.35	0.41	25	29	33	37
	Wall, 24 inches thick	....	....	0.45	....	0.35	....	....	0.31	0.37	22	26	30	33
	Wall, 28 inches thick	....	....	0.41	....	0.31	....	....	0.28	0.33	20	23	26	29
	Wall, 32 inches thick	....	....	0.36	....	0.28	....	....	0.25	0.29	17	21	24	27
Sandstone	Wall, 12 inches thick	....	....	0.58	....	0.45	0.28	....	....	0.44	26	31	35	40
	Wall, 16 inches thick	....	....	0.51	....	0.39	....	....	....	0.45	27	31	36	41
	Wall, 20 inches thick	....	....	0.45	....	0.35	....	....	....	0.40	24	28	32	30
	Wall, 24 inches thick	....	....	0.41	....	0.31	0.23	....	....	0.31	19	22	25	28
	Wall, 28 inches thick	....	....	0.37	....	0.28	....	....	....	0.32	19	22	25	28
	Wall, 32 inches thick	....	....	0.31	....	0.26	0.19	....	....	0.32	19	22	25	38
Concrete	Wall, 4 inches thick	....	....	....	....	....	....	1.07	....	1.07	64	75	86	96
	Wall, 6 inches thick	....	....	....	....	....	....	0.7	....	0.7	42	49	56	63
	Wall, 8 inches thick	....	....	0.49	....	....	....	0.53	....	0.51	31	36	41	46
	Wall, 12 inches thick	....	....	0.43	0.48	....	....	0.36	....	0.42	25	29	34	38
	Wall, 16 inches thick	....	....	0.37	....	....	....	0.26	....	0.31	19	22	25	28
Wood	Clapboards	....	....	....	....	....	....	0.47		0.47	28	33	38	42
	Clapboards, paper lined	....	....	....	....	....	....	0.34		0.34	20	24	27	31
	Clapboards, sheathed	....	....	....	0.31	....	....	0.3	3	0.30	18	21	24	21
	Clapboards, sheathed and paper lined	....	....	....	....	....	....	0.26	average	0.26	16	18	21	23
	Clapboards, sheathed, paper lined and brick plastered	....	....	....	0.20	....	0.25	0.21	....	0.22	13	15	18	20
	Concrete, cinder fill, 2 inches	....	....	....	....	....	....	0.76	....	0.16	45	53	60	68
	Concrete, cinder fill, 4 inches	....	....	....	....	....	0.6	Don'ly	....	0.6	36	42	48	54
	Concrete, cinder fill, 6 inches	....	....	....	....	....	0.5	0.43	....	0.31	19	22	25	28
	Slate, sheathed	....	....	0.43	....	....	0.43	0.36	....	0.41	25	29	33	37
	Tin, sheathed	....	....	....	....	....	....	0.31	....	0.31	19	22	25	28
	Shingle, sheathed	....	....	....	....	....	....	0.29	....	0.29	17	21	23	26
	Tar and gravel	....	....	....	....	....	....	0.29	....	0.29	17	21	23	26
	Mill tar and gravel	....	....	....	....	....	....	0.2	....	0.20	12	14	16	18
	Shingle roof, sheathed	....	....	....	0.31	....	....	....	....	0.31	19	22	25	28
Doors		....	0.414	....	0.34	....	0.31	....	....	0.35	21	25	28	31
		....	....	....	0.55	0.41	0.48	....	....	0.48	29	34	38	43
	Hardwood, ¾ inch	....	....	0.69	....	....	....	....	....	0.69	41	48	55	62
	Hardwood, 1 inch	....	....	0.63	....	....	....	....	....	0.63	38	44	50	57
	Hardwood, 1½ inches	....	....	0.53	....	....	....	....	....	0.53	32	37	42	48
	Hardwood, 2 inches	....	....	0.46	....	....	....	....	....	0.46	28	32	37	41
Roofs	Corregated iron	....	....	....	....	....	....	....	....	2.17	130	152	174	195
	Tiles, rafters boarded on one side	....	....	....	....	....	....	....	....	0.35	21	25	28	32
	Tiles, rafters boarded on both sides	....	....	....	....	....	....	....	....	0.18	11	13	14	16
Flat roofs	Lead or zinc covered lath and plaster, ceiling under	....	....	....	....	....	....	....	....	0.17	10	12	14	15
	Concrete and steel, laid with asphalt:													
	Concrete, 5 inches thick	....	....	....	....	....	....	....	....	0.30	18	21	24	27
	Concrete, 6 inches thick	....	....	....	....	....	....	....	....	0.22	17	20	22	25
	Concrete, 7 inches thick	....	....	....	....	....	....	....	....	0.27	16	19	22	24
	Concrete, 9 inches thick	....	....	....	....	....	....	....	....	0.25	15	18	20	23
	Concrete, 11 inches thick	....	....	....	....	....	....	....	....	0.23	14	16	18	21
	Concrete, 13 inches thick	....	....	....	....	....	....	....	....	0.21	13	15	17	19
Floor	Joist floor with 1½-inch flooring and lath and plaster under													
	Cold air above	....	....	....	....	....	....	....	....	0.17	10	12	14	15
	Cold air under	....	....	....	....	....	....	....	....	0.07	4	5	6	6
	Concrete and steel, 1½-inch floor laid on concrete, no air space, plaster ceiling:													
	Concrete, 5 inches thick	....	....	....	....	....	....	....	....	0.20	12	14	16	18
	Concrete, 7 inches thick	....	....	....	....	....	....	....	....	0.19	..	..	..	..
	Concrete, 9 inches thick	....	....	....	....	....	....	....	....	0.18	11	13	14	16
	Concrete, 11 inches thick	....	....	....	....	....	....	....	....	0.17	10	12	14	15
	Concrete, 13 inches thick	....	....	....	....	....	....	....	....	0.16	10	11	13	15
	Concrete and steel, 1½-inch floor laid on concrete, air space between concrete and flooring, cold air above:													
	Concrete to 9 inches thick	....	....	....	....	....	....	....	....	0.16	10	11	13	15
	Concrete to 13 inches thick	....	....	....	....	....	....	....	....	0.14	..	..	..	..
	Joist floor with air space and 6 inches of concrete on earth	....	....	....	....	....	....	....	....	0.05	8	10	11	13
	6 inches of concrete on ground, ¾-inch cement screed and 1½-inch wood floor over	....	....	....	....	....	....	....	....	0.25	15	18	20	23
	12 inches of concrete on ground, ¾-inch cement screed and 1½-inch wood floor over	....	....	....	....	....	....	....	....	0.20	12	14	16	18
Partitions	Lath plastered on both sides	....	....	....	....	....	....	....	....	0.33	20	23	26	30
	Match boarding	....	....	....	....	....	....	....	....	0.40	24	28	32	36

*According to hight.

TABLE 2—B. T. U. REQUIRED FOR HEATING AIR.

(This table specifies the quantity of heat in British thermal units required to raise one cubic foot of air through any given temperature interval.)

External Temp. —Deg. F.	Temperature of Air in Room—Deg. F. 40	50	60	70	80	90	100	110	120	130
—40	1.802	2.027	2.252	2.479	2.703	2.928	3.154	3.379	3.604	3.829
—30	1.540	1.766	1.980	2.200	2.420	2.640	2.860	3.080	3.300	3.520
—20	1.290	1.505	1.720	1.935	2.150	2.365	2.580	2.795	3.010	3.225
—10	1.051	1.262	1.473	1.684	1.892	2.102	2.311	2.522	2.732	2.943
0	0.822	1.028	1.234	1.439	1.645	1.851	2.056	2.262	2.467	2.673
10	0.604	0.805	1.007	1.208	1.409	1.611	1.812	2.013	2.215	2.416
20	0.393	0.590	0.787	0.984	1.181	1.378	1.575	1.771	1.968	2.165
30	0.192	0.385	0.578	0.770	0.963	1.155	1.345	1.540	1.733	1.925
40	0.000	0.188	0.376	0.564	0.752	0.940	1.128	1.316	1.504	1.692
50	0.000	0.000	0.184	0.367	0.551	0.735	0.918	1.102	1.286	1.470
60	0.000	0.000	0.000	0.179	0.359	0.538	0.718	0.897	1.077	1.256
70	0.000	0.000	0.000	0.000	0.175	0.350	0.525	0.700	0.875	1.049

Above table from F. Schumann's Manual of Heating and Ventilation, pages 41 and 64.

these three losses are found, in B.T.U. per hour, and the sum is divided by the B.T.U. emitted by 1 sq. ft. of radiation surface as found in Table 3, second column, the quotient will be the desired size of radiator for steam heat. For hot water heating use Table 5 and proceed as for steam; or 60% may be added to the amount of radiation as determined for steam.

To determine the heat losses in B.T.U. per hour, use Table 1, in which will be noted losses for the glass, side walls and roof. Table 2 will give the B.T.U. required to heat 1 cu. ft. of air the required amount. One change of air per hour is generally used, though two changes for living rooms with fireplace or when open to a hall, three for entrance halls, and ¾ to 1½ changes for factories, lofts, etc., should be allowed for.

Suppose a room contains the following quantities and is to be heated to 70° F. in zero weather with steam heat:

Glass surface ..... G = 100 sq. ft.
13-in. brick and plaster wall ..... W = 400 sq. ft.
Cubic contents ..... V = 4000 cu. ft.
Temperature difference. 70° F.
(One air change per hour.)

Look up these surfaces in Table 1 and proceed as follows:

G = 100 x 71..... = 7,100 B.T.U.
W = 400 x 16..... = 6,400 B.T.U.
V = 4,000 x 1.439..... = 5,756 B.T.U.
One air change per hour.
Total heat loss = 19,256 B.T.U. per hour.

TABLE 3—STEAM RADIATORS—HEAT TRANSMISSION FOR VARYING ROOM TEMPERATURES PER SQUARE FOOT SURFACE.

Room Temperature— Deg. F.	B. T. U. Per Hour.	Pounds of Steam Condensed Per Hour.	Relative Condensation, Pounds.
130	127	0.132	52.6
125	135	0.141	56.2
120	144	0.150	60.0
115	153	0.159	63.8
110	162	0.169	67.5
105	171	0.178	71.2
100	180	0.188	75.0
95	190	0.198	79.2
90	200	0.208	83.3
85	210	0.218	87.5
80	220	0.229	91.7
75	230	0.240	95.8
70	240	0.250	100.0
65	250	0.260	104.2
60	261	0.272	108.8
55	272	0.283	113.3
50	283	0.295	117.9
45	294	0.306	122.5
40	305	0.318	127.1

TABLE 4—RADIATION AND BOILER CAPACITY REQUIRED FOR VARYING ROOM TEMPERATURES.

Room temperatures, Deg. F.	Per cent. of radiation required.	Per cent. of boiler capacity.
130	350.8	185.8
125	316.8	178.6
120	285.8	171.4
115	257.9	164.3
110	233.0	157.1
105	210.4	150.0
100	190.0	142.9
95	171.4	135.7
90	154.5	128.6
85	139.1	121.4
80	125.0	114.3
75	112.0	107.1
70	100.0	100.0
65	89.0	92.8
60	78.8	85.7
55	69.3	78.6
50	60.6	71.4
45	52.5	64.3
40	44.9	57.1

From Table 3 it is noted that 1 sq. ft. of radiator standing in a room at 70° F. emits 240 B.T.U. per hour; therefore 19,256 ÷ 240 = 80.2 sq. ft.

For hot water heat, using Table 5, 19,256 ÷ 150 = 128.4 sq. ft., which is 60% more than the steam surface.

Had the above losses been figured for 80° room temperature and zero outdoors, or 80° difference, the total loss per hour would have been 80/70 × 19,256 = 22,000 B.T.U., but the radiators standing in air 80° will not transmit as much heat, and Table 3, second column, gives 220 B.T.U. per hour as the amount; Table 5 for hot water gives 22,000 ÷ 220 = 100 sq. feet.

This result could be obtained by the use of Table 4, thus: In the second column, opposite 80°, we find 125%. That means that a room requires 25% more radiating surface to heat it to 80° than to 70°.

Radiation to heat room to 70°. 80 sq. ft.
Plus 25% ..... 20 sq. ft.
To heat room to 80°.....100 sq. ft.

This table is very handy when several room temperatures are under consideration; also when the radiation has been computed by means of either of the following rules which are correct for 70° and some other temperature is desired. Note the rapid increase in the radiation as the room temperature rises.

SHORT AND HANDY RULES FOR COMPUTING RADIATION.

The following rules are based upon the B.T.U. method, assuming standard conditions, i. e., 70° F. indoors and zero outside, that each square foot of glass requires 71 B.T.U., the walls transmit 22 B.T.U., and one air change per hour

$$\frac{G}{5} - \frac{S}{10} - \frac{V}{150} = \text{square feet of radiation, steam.}$$

$$\frac{G}{3} - \frac{S}{7} - \frac{V}{100} = \text{square feet of radiation, hot water.}$$

where G = square feet of glass surface.
S = square feet of exposed wall (including glass).
V = volume of room in cubic feet.

Note that S is not the net exposed wall surface, as given in most rules. This saves the labor of subtracting the glass from exposed wall area, which is often forgotten. This subtraction has been done in the formulas.

Another rule, much used, though probably not based on the B.T.U. loss method, is:

$$\frac{G}{4} - \frac{S}{10} - \frac{V}{200} = \text{square feet of radiation, steam heat.}$$

Should it be desired to determine the heating surface required for any other outdoor temperature than zero, any of the three above rules may be used. Then, by turning to Table 6, note the per cent. required and multiply the result of the rule by this percentage, thus: Suppose

TABLE 5—HEAT TRANSMITTED FROM HOT WATER RADIATORS PER SQUARE FOOT AT VARYING ROOM TEMPERATURES.

Room Temperature, Deg. F.	B.T.U. per Square foot per hour
80*	135.0
75	142.5
70	150.0
65	157.5
60	165.0

* Approximate.

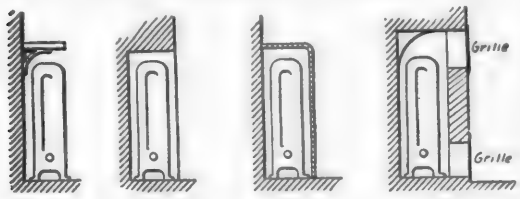
TABLE 6—RADIATION REQUIRED AT VARIOUS OUTDOOR TEMPERATURES (ROOM TEMPERATURE = 70° F.)

Outdoor temperature, deg. F.	35	30	25	20	15	10	5	0	—5	—10	—15	—20
Per cent. of radiation	50	57	64	71	79	86	93	100	107	114	121	129

Rule 1 indicates 200 sq. ft. as the radiation for a certain room. This would be for 70° indoors and zero outside. Suppose the minimum temperature to be allowed for was —20°. Table 6 demands 129% or 258 sq. ft.: 200 × 1.29 = 258 sq. ft.

RECESSED RADIATORS.

When the circulation of air about and through a radiator is interefered with in any way, its efficiency is reduced. Ac-



TYPICAL RECESSED RADIATOR SETTINGS.

cording to C. A. Fuller in his book, "Heating and Ventilating Systems," these reductions are as follows:

Fig. 1..... 10%
Fig. 2..... 15%
Fig. 3..... 25%
Fig. 4..... 30%

In the case of Fig. 4 care must be taken that the grilles or register faces run full length of the radiator and that the free area of each of the grilles is approximately 3 sq. in. per foot of radiation.

BRONZING AND ENAMELING RADIATORS.

In the Transactions of The American Society of Heating and Ventilating Engineers for 1909, Professor John R. Allen gives the results of his experiments relating to the efficiency of various paints, enamels and bronzes when used for decorating radiators. These experiments demonstrate that bronzes are not as good for covering radiators as enamels and some paints.

It was also shown from the experiments that the number of coats of paint made very little difference, but the kind that was put on last made a very great difference to the radiator's efficiency:

Coating of Radiators.	Comparative Efficiency of Radiating Surface.
Plain, as received from factory	1.005
Aluminum bronze	0.730
Copper bronze	0.752
Terra-cotta enamel	1.038
Light brown varnish	0.977
Silver gray enamel	0.970
Snow white enamel	1.010
Bronze green enamel	0.997
No-lustre green enamel	0.956
Maroon gloss Japan	0.997
White paint	0.987
Terra-cotta paint	1.000
Light green paint	0.989

BOILER CAPACITY REQUIRED.

It is the general practice of reliable boiler manufacturers to rate their boilers upon an 8-hour firing basis, excepting in the very large sizes, where a fireman will be in attendance

The "8-hour rating" can be explained in the following manner: Allowing 20% of the fuel charge to remain unconsumed at the end of the run as a rekindling charge, the remaining 80%, if burned in 8 hours, will produce steam at such a rate as to supply an amount of radiation, standing in still air 70° F., equal to the boiler's rated capacity.

Should the charge be consumed in 4 hours the rate of combustion would be double that of the 8-hour rate and the boiler would care for twice the load of radiation. That is a 1,000-sq. ft. boiler becomes a 2,000-sq. ft. boiler when run on a 4-hour firing basis.

The above shows the necessity of knowing how the rating of a boiler has been determined, as the catalogue rating means nothing unless the firing period be known.

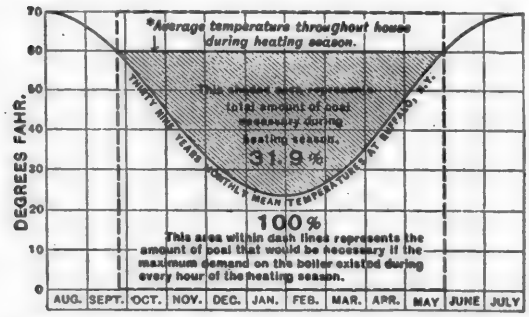
Each square foot of radiation standing

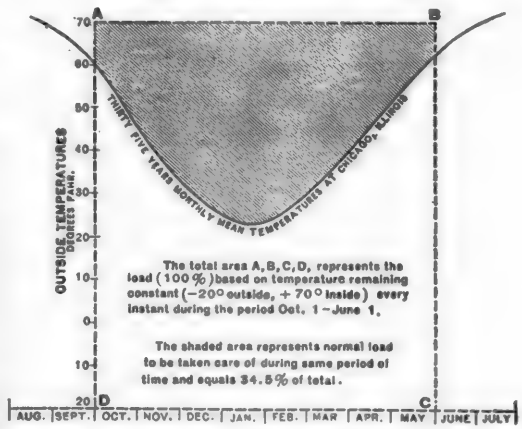
in still air at 70° is considered as requiring ¼ lb. of steam per hour; so rated capacities in square feet may be transformed to pounds of steam by dividing by four and conversely

In choosing the proper size of boiler for any given job, there must be considered the heat losses from the pipes, sides of boiler, possible poor coal and bad draft conditions.

The radiation from covered pipes and boiler may be considered as averaging 25% of the direct radiation installed, and allowing 25% more for poor coal, etc., the boiler would be of 50% greater capacity than the radiation installed.

Thus, if a building has 1,000 sq. ft. of radiation, the proper boiler would be one of 1,500 sq. ft. rated capacity for


*Average temperature throughout house during heating season.
This shaded area represents total amount of coal necessary during heating season.
31.9%
100%
This area within dash lines represents the amount of coal that would be necessary if the maximum demand on the boiler existed during every hour of the heating season.
THIRTY NINE YEARS MONTHLY MEAN TEMPERATURES AT BUFFALO, N.Y.
DEGREES FAHR.
AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY


A
B
C
D
THIRTY FIVE YEARS MONTHLY MEAN TEMPERATURES AT CHICAGO, ILLINOIS
OUTSIDE TEMPERATURES DEGREES FAHR.
The total area A,B,C,D, represents the load (100%) based on temperature remaining constant (−20° outside, + 70° inside) every instant during the period Oct. 1 − June 1.
The shaded area represents normal load to be taken care of during same period of time and equals 34.5% of total.
AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR APR. MAY JUNE JULY

NORMAL COAL REQUIREMENTS AT BUFFALO, N. Y., AND CHICAGO, ILL., DURING HEATING SEASON.

average conditions and 70° room temperatures.

But suppose another room temperature than 70° is to be used? Table 4, column 3, will give the relative boiler capacity needed considering that needed at 70° as a standard; thus if a building needs 1,000 sq. ft. to heat it to 70° and a 1,500-sq. ft. boiler, to obtain 85° would require 1,000 × 1.39 = 1,390 sq. ft. of radiation, and 1,500 × 1.21 = 1,820-sq. ft. boiler.

Note that the boiler capacity does not increase as rapidly as does the radiation for the reason that as the room temperature rises the radiators become less efficient.

If the heat losses have been computed by the B.T.U. method, Table 3, column 3, will give the steam condensed per square foot of radiation per hour; this, times the total square feet of radiation, gives the steam condensed. Add to this steam condensed in mains and risers; also losses due to boiler radiation, and the sum is the tax on the boiler in pounds of steam. Add sufficient to cover any other losses.

Tax (in pounds of steam) × 4 = catalogue rating of boiler square feet of radiation.

DETERMINING THE COAL CONSUMPTION.

It is generally believed and is probably true that if the prospective purchaser is told that 500 sq. ft. of radiation will require 14 lbs. of coal per hour to keep the radiation steadily filled with steam, he will multiply the 14 lbs. by 5,000 hours (the average length of the northern heating season), showing a consumption of 35 tons of coal, whereas the maximum hourly demand is no indication of the season's normal demand because the entire quantity of radiation is in commission for very short periods, two or three hours per day for a total of possibly ten or twelve days during the entire heating season. The maximum hourly demand indicates 35 tons for a season, while good practice demonstrates that the consumption will be about 10 or 12 tons.

In other words the coal required for a heating season is about one-third the quantity that would be used if all the radiation were in constant use every hour of the day and night.

The above charts show the normal demands at Buffalo and Chicago.

A Survey of Operating Costs in Thirteen School Buildings

Analysis of the Heating and Ventilating Figures in the Jamestown (N. Y.) Public Schools.

By JOHN M. CUSHMAN,

Member of the Board of Education, Jamestown, N. Y.

JAMESTOWN'S PUBLIC SCHOOL BUILDINGS.

POWER-VENTILATED GROUP.

Name.	How Heated.	How Ventilated.	Character of System.	Fuel.
*High	.....	.....	Old	.....
Sherman Street	Furnaces and steam boiler	Fan driven by electric motor	Furnaces old, steam new.	Hard coal and gas
Fairmount	Steam boilers	Fan driven by electric motor	New	Hard coal and gas
No. 5	Warm air furnaces	Fan driven by gas	Old	Natural gas
No. 6	Warm air furnaces	Fan driven by electric motor	New	Hard coal and gas
No. 9	Steam boilers	Fan driven by electric motor	New	Natural gas and anthracite coal
No. 10	Warm air furnaces	Fan driven by electric motor	Old	Anthracite coal and gas

NO-POSITIVE-VENTILATION GROUP.

Central	Steam boilers	Gravity	Old	Natural gas, supplemented by anthracite coal ****
No. 1	Steam boilers	Gravity	Old	
No. 2	Warm air furnaces	Gravity	Old	
No. 3	Warm air furnaces and steam boiler	Gravity	Old	
No. 4	Steam boilers	Gravity	Old	
**No. 7	Steam boilers	***	New	
No. 8	Steam boilers	Gravity	Old	

*This building has such inadequate ventilation that it cannot be properly included in the group with power ventilation, even though there is some ventilation by power.

**This school was not in use for a whole year and does not afford sufficient data for a proper comparison.

***Ventilating fan in each room, taking air from partly-opened window; air exhausted into corridors.

****School No. 7 is heated with hard coal only.

In a survey of the costs to heat and ventilate the school buildings of Jamestown, N. Y., one is confronted at the start with the necessity of dividing the buildings into groups. That there are two natural divisions or groups is apparent if one considers the fact that in one group parts of the buildings are ventilated by a system of forced ventilation, whereas in the other group no forced or positive system of ventilation is in use.

In considering the costs of heating and ventilating the writer has chosen two: the "per pupil" method and the "per unit of size" method. In considering the costs by the "per pupil" method one is liable to overlook many important features of a building which are reckoned with when estimating by the "per unit of size" method.

A most convenient unit of size is the unit containing 1,000 cu. ft. heated and ventilated for a period of one year. In

view of wide differences in equipment, a unit of size, based upon cubic contents heated and ventilated, seems the only feasible thing to adopt for purposes of comparison.

By making a study of the various charts, showing the costs to heat and ventilate, per pupil, and per 1,000 cu. ft., it will be noted, there are wide differences in the costs to do the same work in the different buildings of the same group.

It is likely that in any group of school houses there will be one building that, from the point of view of operative costs, might serve as a model building for the group. Whether this particular building answers all the requirements of an ideal school house or not matters but little so long as it serves as a standard by which to measure the efficiency of the rest of the group.

Of the six buildings of the power-ventilated group, the Fairmount School easily takes the place as a model.

In contrast with the Fairmount School certain other schools of this group, notably Nos. 9 and 10, are exceedingly costly to operate.

An effort is made to analyze these great differences in costs by illustrating the continued or increased use of certain kinds of fuel as they relate to the costs.

Even in a model building there are always possibilities for economies by changing fuel, or methods of procuring ventilation.

This survey extends over a period of three years, covering the years 1912-'13, 1913-'14 and 1914-'15.

In determining the cubic contents of the several buildings I have made use of estimates furnished by architects, in some instances measurements furnished by school employees, and in others my own measurements.

The costs have been obtained by reference to the fuel and power bills themselves. Comparisons have also been made, where possible, with such records of costs and other data as are to be found in the office of the Board of Education.

The writer claims but little more for his figures than that they are illustrative rather than exact.

If in one group, the more important group, perhaps, which might be designated as the power-ventilated group, it can be shown that the costs to do the same work, that is, heat and ventilate 1,000 cu. ft. for a year, varies all the way from $1.93 to $4.81, one would have to admit that it mattered little whether these figures were exact to a cent or not.

FUEL VALUES

Value of the different kinds of fuel used in the school houses of Jamestown, N. Y., during the years 1914-'15.

COST OF FUEL

Natural gas, per 1,000 cu. ft.....32½c
Anthracite coal, pea grade, per ton delivered $4.74
Egg grade, per ton, delivered..... 5.97

During this same year the school district of Erie, Pa. paid $2.20 a ton, delivered, for a first quality of bituminous coal. The coal was sold under a guarantee as to the heat units.

The B. T. U. values of the above fuels are, approximately:

Natural gas, per cu. ft. 1,232 B. T. U.
Anthracite coal, per lb. 12,679 B. T. U.
Bituminous coal per lb. 14,119 B. T. U.

At the above prices for fuel $1.00 will buy in heat units approximately as follows:

Natural gas, $1.00 worth at $0.32 per 1,000 cu. ft. equals 5,420,800 B. T. U. Anthracite coal, pea, $1.00 worth at $4.74 per ton equals 5,325,180 B. T. U. Anthracite coal, egg, $1.00 worth at $5.97 per ton equals 4,057,280 B. T. U. Bituminous coal, such as Erie bought, $1.00 worth at $2.20 per ton equals 12,707,100 B. T. U.

THE POWER VENTILATED GROUP

In this group of buildings some attempt is being made to comply with the statutes of the State as regards the matter of ventilation. The requirements are that there shall be ventilation that is "positive and independent of atmospheric changes," that there shall be "assured at least 30 cu. ft. of pure air every minute per pupil."

School No. 5 is one of the buildings where the air of the corridors and nearby

toilet rooms, at times, is circulated along with, or, in place of the pure fresh air from out-of-doors.

The chief reason for this contamination of the air, delivered to the school room, is that the furnaces are insufficient to properly heat the outside air if the weather is very cold.

It is very evident that the costs to heat and ventilate in this building are too low. The expense to do this work, if it were done thoroughly, and with no taking of air from the interior of the building, would be much higher.

As will be seen by reference to another page there are two other school buildings (Nos. 9 and 10) where at times it may be observed that there is a mixture of the fresh air with the foul air of the corridors and of the toilets.

In these two buildings there is probably no other reason for this practice except that of insufficient furnaces on the part of No. 10, and insufficient boilers in No. 9.

The heating and ventilating apparatus in school No. 5 is old, and furthermore, during severe weather the furnaces in this building are operated at their full capacity, and yet are insufficient to raise the temperature of a proper quantity of outside air to the temperature for a school room.

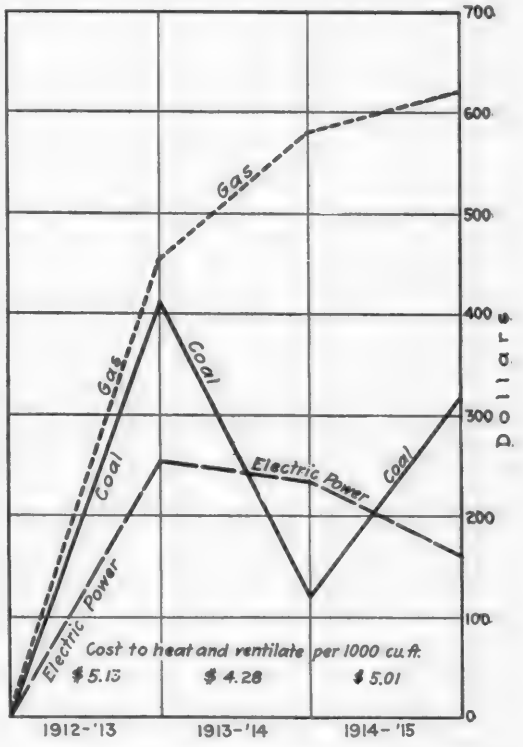
The only fuel used in No. 5 is natural gas, the fuel value of which is shown on another page.

Furnaces are also in use in school No. 10. The fuel used there being both natural gas and anthracite coal. The fan is operated by an electric motor. The heating apparatus is by no means new. In this building the practice of taking air from the inside of the building during severe weather is aggravated by the fact that the boys' toilet room is situated near the door of the fan room, which is sometimes opened to take the air from the interior of the building. This toilet room is poorly ventilated at the best, the toilet apparatus being of antiquated type that is never free from disagreeable odors.

School No. 9 is equipped with an entirely new heating and ventilating system, the three years which are covered by this survey being practically the three first years of its operation. The source of heat is two steam boilers. The fan is operated by an electric motor. It has been a practice in this building in severe winter weather to open the door of the fan room for the purpose of admitting the air of the corridors and incidently the air of the toilet rooms and the gymnasium.

The fuel used in this building is natural gas and anthracite coal.

The failure to use pure fresh air from



HEATING AND VENTILATING COSTS, SCHOOL NO. 9.

out-of-doors entirely and every day in the year is evidently owing to the lack of steam pressure. The pressure in the boilers is kept at a low point as a part of the scheme of heating, which is a "vacuum system."

This building is the only one of the group, if not the only one in the city, that is equipped with any sort of an apparatus to regulate the humidity of the air admitted to the school room. During the three years of this survey this particular piece of apparatus was never in use.

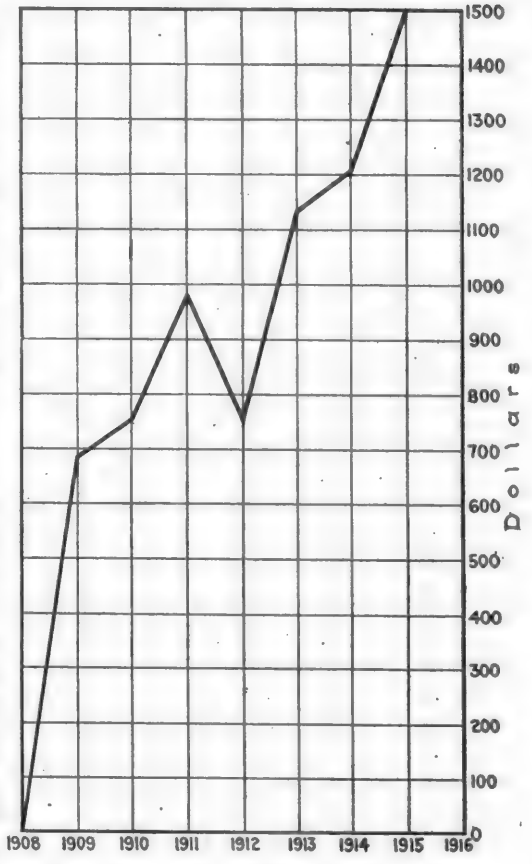
It will be noted that school No. 9 is the most expensive to operate of any in

this group. And this, too, in the face of the fact that not all is accomplished by the system that is expected of it. Were this system to deliver "30 cu. ft. of pure air every minute per pupil," and do this every school day all winter long, it is safe to assume that the costs to operate would be well above $5.00 per 1,000 cu. ft.

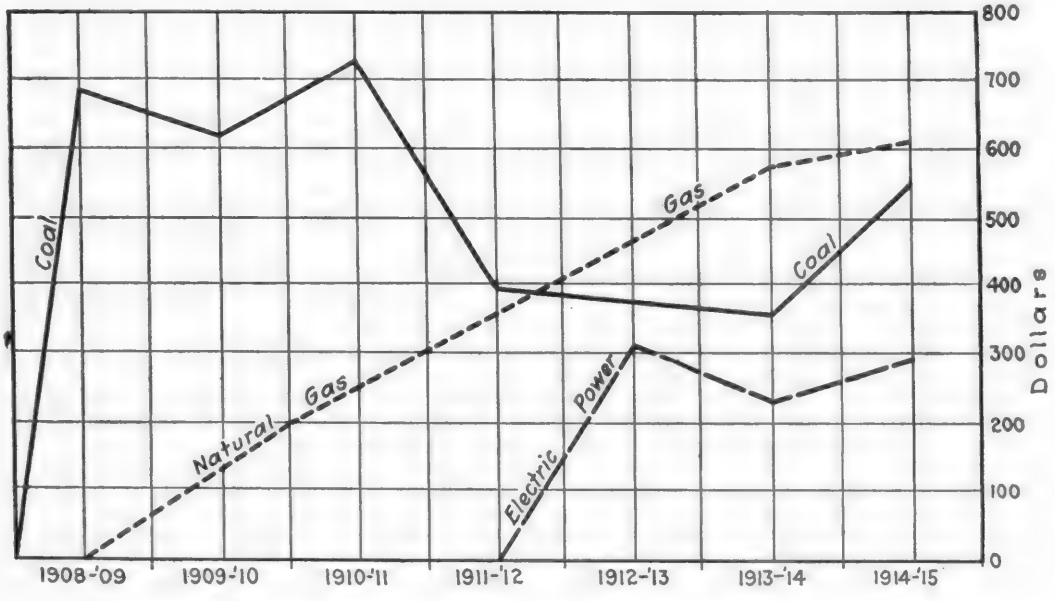
The three remaining buildings of this group are being operated at costs running from $2.31 at school No. 6, $2.34 at the new Fairmount school, to $2.54 at the Sherman Street school.

AVERAGE HEATING COST.

The average cost, it will be noted, is $3.08. In school No. 6 and the Sherman Street school the buildings are thoroughly heated and each pupil is getting approximately the proper quantity of pure air. In the new Fairmount school there is no question about whether the pupils are getting the right amount of air. In this building everything that is required by a statute as regards ventilation is being done with 100 per cent. efficiency and at a cost about one-half of that of school No. 9. The Fairmount school building easily becomes the typical building for the group.



HEATING AND VENTILATING COSTS, SHERMAN STREET SCHOOL, 1908-1915.



DETAILED COSTS OF OPERATION, SHERMAN STREET SCHOOL, 1908-1915.

HEATING AND VENTILATING COSTS, POWER VENTILATED GROUP.

	Three years, 1912-15 average cost per pupil.	Cost per 1,000 cu. ft. to heat and ventilate for the year 1914-'15.
School No. 5.....	72c	$2.11
School No. 10.....	$1.43	5.36
School No. 6.....	1.78	2.52
Sherman Street School..	2.20	2.91
School No. 9.....	2.44	5.01
Fairmount School	2.50*	2.34

*Cost for one year 1914-'15.

has automatic heat regulation under the control of thermostats situated in the school rooms. None is supplied with apparatus to control the amount of humidity in the air of the school room.

In two of the buildings, school No. 3 and the Central school, the heating apparatus is situated under the front entrance.

In none of these buildings is there fireproof doors between the boiler room, or furnace room and the rest of the building.

School No. 2 is heated by a furnace, No. 3 by furnaces and a steam boiler, the

AVERAGE HEATING AND VENTILATING COSTS PER 1,000 CU. FT. AND OTHER DATA, POWER VENTILATED GROUP.

	No. 5.	No. 6.	Fairmount School.†	Sherman School.	No. 10.	No. 9.
Average cost, years 1912-'15, to heat and ventilate per 1,000 cu. ft.	$1.93	$2.31	$2.34	$2.54	$4.59	$4.81
Recirculation of the air of the corridors and toilets in extreme cold weather.....	Yes	No	No	No	Yes	Yes
Apparatus to regulate the humidity of air in school rooms....	No	No	No	No	No	Yes, but not in use during the three years.
Automatic heat regulation by thermostat in school room.....	Yes	Yes	Yes	Part	Yes	Yes
Fire proof doors to boiler or furnace room	No	Yes	Yes	No	No	No
Source of heat.....	*	*	***	***	*	**

(*Furnaces) (**Steam boiler) (***Combination furnaces and boiler)
† Fairmount School for year 1914-'15 only.

THE GROUP WITH NO POSITIVE VENTILATION.

In the group of school houses with no positive ventilation there is, of course, some ventilation, but such ventilation as there is has been obtained by the "gravity" method. The education law, section 451, requires that ventilation shall be "positive and independent of atmospheric changes."

In the buildings of this group there is no forced supply of air delivered in any definite quantity. The only means of getting fresh air into the rooms is that the heated air of the rooms ascends through ventilating flues that are provided in connection with each room. In the place of this foul or vitiated air a certain indefinite quantity of fresh air finds its way to the school rooms through fresh air ducts.

None of the buildings of this group remaining four of the group by steam boilers.

The fuel used in all of the buildings is natural gas, supplemented by anthracite coal during severe winter weather.

It will be noticed that in this group the average cost to heat and ventilate is about 6 per cent. higher than in the "power ventilated group." While the costs are higher in this group there is no doubt that the actual work done is very much less.

The problem of supplying pure fresh air in the required amount is a most serious one in connection with this group of buildings, for it not only means additional heating facilities, but in each building the installation of some sort of a blower to force the fresh air into the school rooms.

All of these additions, while a serious expense, are absolutely necessary if the

buildings are to be operated according to the statutes of the State.

Four of the buildings use natural gas alone as a fuel and the consumption of fuel seems to follow very closely the changes in temperature. Gas fires are easily made to respond to changes in the weather. The buildings using gas exclusively correspond very closely one with another, during the same months, as to costs to heat. This fact furnishes an excellent guide to the weather conditions in Jamestown which, if applied to the heating costs in certain of the buildings of the power ventilated group, would show that some other factor besides weather is responsible for many excessive bills of fuel in that group.

Average heating and ventilating costs per 1,000 cu. ft. No positive ventilation group. Three years, 1912-'15.

Central School	$1.09
School No. 1	1.99
School No. 3	3.98
School No. 4	3.99
School No. 8	4.02
School No. 2	4.51
Average cost	3.26

NO. 9 SCHOOL

In connection with the heating of this building it will be noted that there is a steady increase in the use of gas.

The gas bill for the year 1912-'13 was $463.00; 1913-'14, $582.00; 1914-'15, $621.00. In view of the value of natural gas as a fuel, when considered from the point of view of heat units per dollar, it is regrettable that the use of this fuel should be on the increase.

The coal burned in this building is of the variety known as egg coal and costs nearly $6.00 a ton. This coal has no particular warrant for its use over the cheaper varieties of hard coal except that of ease in handling, and that the fires require less attention.

A change in grates would be about the only expense connected with a change from the expensive egg coal to the cheaper pea coal.

A study of the operation of the Fairmount School would lead one to believe pea coal could well be substituted in No. 9 school with a very substantial saving. This is not, of course, taking into consideration the still greater saving that might be made if soft coal should be substituted for both the gas and the coal now used.

An interesting comparison may be made between this building and the Fairmount school as to the cost to ventilate; the Fairmount School has a contents of about 450,000 cu. ft., the electric power in 1914-'15 cost $187.00, at the rate of about 40c per 1,000 cu. ft. per year.

No. 9 school has a contents of about 219,000 cu. ft., with a cost for power of about $650.00 for the last three years. This was at the average rate of $216.00 a year, or $1.00 per 1,000 cu. ft. per year.

The comparison of costs for electric power, not current used for light or vacuum cleaner, taken in connection with the fact that in the Fairmount School the ventilation is practically perfect, while No. 9, with an expense for doing the same thing poorly, is about 250 per cent. higher, leads one to think that here is a fertile field for improvement.

If one were to look further for a comparison of costs in ventilation, No. 5 school might be compared with any of the electric motor-using schools. The cost to operate the gas engine in No. 5 has been about 13c per 1,000 cu. ft. per year.

If one were to overlook the noise in connection with a gas engine, even the Fairmount School might have the cost to ventilate reduced about one-third.

The annual expense of heating and ventilating school No. 9 of about $1,100.00 might be reduced to something like $350.00 if soft coal could be adopted as the principal fuel and a gas engine be installed instead of the electric motor for ventilating.

Soft coal can be burned without smoke and a gas engine can be operated without a great amount of noise, if properly installed.

It might be mentioned that the outfit for heating and ventilating in No. 9 is practically new. The apparatus was all of a very promising type, yet it had hardly been put into use before it was found to be difficult to operate and, as the charts show, very expensive.

A proposition amounting to $1,400.00

was made to the Board of Education, offering to modify the outfit so as to do away with the seemingly objectionable features of the apparatus. The proposition was accepted and this amount spent, yet there still seems to be much to be done if this building is ever to be operated at as low a cost as are several of the other school buildings.

In the beginning, a steam pump was in operation in No. 9 for the purpose of returning the water of condensation to the boiler. When the $1,400.00 remodeling was undertaken the steam pump was exchanged for an electric motor.

As a practical business proposition the $1,400.00 investment has not shown to good advantage in lowering the costs, as the costs for the year 1914-'15 are only about $28.00, or 2 per cent. lower than they were before making so expensive an addition to an entirely new plant.

In this building the fan is supplying, approximately, 22,950 cu. ft. of air per minute, and there is often the necessity of raising the temperature of this air from 10° F. below zero to 80°.

In order to successfully accomplish this it is necessary to have 81 H.P. developed in the boiler, when working at 5 lbs. pressure. In order that the 2,153 sq. ft. of direct radiation in the class rooms and other parts of the building can also be taken care of at the same time, an addition of 24 H.P. is needed.

To furnish the necessary 105 H.P., in order that the heating and ventilation may be taken care of under the most trying circumstances, there are two boilers of 38 H.P. each, when operated at 5 lbs. pressure.

From the fact that the boilers in this building are being operated at a very low pressure, called "vacuum," which has in reality been about 1¼ lbs. pressure, it is quite evident that nothing like 76 H.P., much less 105, is ever developed in the boilers of this building.

There need be no surprise that the costs to heat and ventilate in this building are practically 500 per cent. above a good average for doing such work.

THE SHERMAN STREET SCHOOL.

It will be seen by the accompanying chart that coal was the principal fuel during the first years of the building's use, natural gas being gradually used more and more each year as is shown by the ascending gas line. During the first years a steam engine was used as the motive power for ventilation. Its abandonment for an electric motor added something in the way of the electric power costs as shown by that line. At about the time of beginning the use of electricity or ventilation there was a substantial enlargement of the building, which accounts for the large increase in the costs of operation over the previous years. However, it will be noted that the total increase corresponds very closely with the increased use of natural gas as a fuel.

It is to be expected that after a building like a school house, once gets into use and the apparatus has had a fair trial the experience thus gained would be reflected in a lowered cost of operation. The reverse seems to have been the rule in this particular building.

In later years a large part of the gas that was burned was used in connection with a steam boiler. This boiler was never intended to burn a fuel of this character, and as a consequence a very large part of the gas was wasted.

The fact that this particular boiler was a source of much waste led the Board of Education to abandon it and erect in its stead a modern type of boiler adapted to the needs of the building.

In spite of the great waste of gas in this building through the continued use of such a fuel the average costs to heat and ventilate run very close to the costs in the Fairmount School.

THE HIGH SCHOOL.

As the demands of the High School long ago outgrew the resources of the heating and ventilating apparatus, it is almost useless to refer to the operation of that school except to deplore its utter inadequacy. There is, however, one item of the costs in this building that is worthy of note as it well illustrates the sort of expenses that have been connected with its operation.

In reviewing the costs to heat and ventilate in connection with the High School, one meets with a series of costs covering the months of November in each year.

For some years it has been the custom

to burn natural gas almost exclusively from the beginning of the school year up until the first of December. At this time the burning of anthracite coal is commenced, quite largely taking the place of gas.

The consumption of natural gas in the month of November for the years
1913-'14 amounted to.....$380.00
1914-'15 amounted to..... 408.00

If this amount of money each year had been expended for bituminous coal at the prices prevailing in those years, there could have been purchased, approximately

1913-'14.....170 tons
1914-'15.....184 tons

In order to burn this amount of coal in one month it would have been necessary to have burned the coal at the rate of about 6 tons a day for every day of the month, Saturdays, Sundays and school days.

It is a pleasure to note that the people of Jamestown have voted an appropriation enabling the Board of Education to erect a modern power plant outside the High School building. After the completion of this power house and its equipment with modern appliances we may expect a reduction of at least two-thirds in the costs of heating and ventilating.

SCHOOL NO. 10.

This is one of the two school buildings that are the most expensive to heat and ventilate of any in the city.

The costs in round numbers were as follows:

	1912-'13	1913-'14	1914-'15
Gas	$270.00	$304.00	$276.00
Coal	124.00	185.00	322.00
	$394.00	$489.00	$598.00

If $569.00 worth of soft coal had been purchased during those three years there could have been saved $912.00.

The $569.00 worth of soft coal would have had as many heat units as the hard coal and the gas, and have done the same work in heating.

The cost of electric power to ventilate this building

in 1913-'14 was....$135.00
in 1914-'15 was.... 137.00

This was at the rate of about $1.00 per 1,000 cu. ft. per year.

A comparison between this building and the other buildings of the power ventilated group is, approximately, as follows:

Cost per 1,000 cu. ft. per year:

		cu. ft. per min.
No. 5 school...	$0.13 air delivery	18,000
Fairmount	0.40 " "	34,000
Sherman St....	0.54 " "	32,000
No. 6 school...	0.65 " "	22,000
No. 9 school...	1.00 " "	23,000
No. 10 school..	1.00 " "	18,000

Schools No. 5 and 10 have little more to be ventilated than the school rooms themselves, No. 9 has a small gymnasium, the other three schools have, each of them, a gymnasium and auditorium.

It will be noted that the ventilating costs in No. 5 and 10 for doing practically the same work, viz:—move 18,000 cu. ft. of air per minute, are as 13c is to $1.00.

It seems impossible that all of the 800 per cent. increase in No. 10, over the cost at No. 5, must be charged to the comfort of having an electric motor to operate the ventilating fan, rather than a gas engine.

POSSIBLE CHANGES IN FUEL AND POWER.

A considerable saving may possibly be effected by burning natural gas in those school houses where no janitors are employed during the entire day. In these buildings the principal of the school usually has charge of the gas fires, regulating them according to the weather. The avoidance of janitor hire easily offsets any undue expense incurred by burning gas.

The fact that school No. 2 has been operated at an expense over 400 per cent. above the expense at Central School would lead one to believe that the apparatus is badly in need of attention.

The same may be said of schools No. 3, 4 and 8. The fact that these four schools Nos. 3, 4, 8 and 2 are costing about 400% more to heat and ventilate, such as it is, than it is costing in Central School is an exhibition of administrative inefficiency.

In those buildings where there is a janitor during the entire day and it is thus possible to use such fuels as would enable the building to be operated at a minimum of expense, it might be of in-

terest to take into consideration what the expenses *might have been* had there been different fuel used, or different methods employed to obtain the forced ventilation.

Of the power ventilated group No. 5, the one operated at the least expense, might be considered first.

This building was operated at an average yearly cost of $1.09, natural gas being the only fuel in use. As this fuel has only about 5,000,000 B. T. U. per dollar's worth as compared with 13,000,000 B. T. U. in a dollar's worth of soft coal, one might look for one of two things, if modern boilers or furnaces were to be installed so that soft coal could be burned without smoke, that is, by burning soft coal the expense might be reduced about one-half, or else the expense remaining the same, the efficiency might be increased 100%.

School No. 6 burns both gas and pea coal. The total cost for fuel in this building for the year 1914-'15 was about $580.00. This amount of money when invested in gas and pea coal will only buy the same number of heat units as would $240.00 invested in soft coal. This is figuring soft coal at the price that it was selling at during the years of this survey.

These differences are inducements for furnace changes so as to be able to take advantage of the great difference in heat unit values between soft coal on the one hand and gas or hard coal on the other.

School No. 7 began operating the steam boilers with pea coal. From the commencement of operations, September, 1914 up to December 1, of that year, $366.00 worth of pea coal had been purchased and burned. Beginning with December 1 and covering the rest of the school year there was purchased and used $646.00 worth of egg coal. The reason for changing fuel may be attributed to the fact that there was such unsatisfactory results following the use of the pea coal in the way of excessive ash or unburned coal that it appeared to the administrative officials as advisable to adopt egg coal. While there was a substantial difference noted at once in the amount of fuel completely burned the cost of heat was advanced 25%.

The failure to burn successfully the cheaper pea coal under the boilers in this building was due largely to two causes. First, the pea coal was of a very inferior quality; second, the grates in the boiler were not adapted to burning as small-sized a coal as pea coal.

The chief reason for not trying to make a comparison of the costs to heat and ventilate this building, with the others of the power ventilated group, is as has been stated; because the building was not in full use until well along into the winter. Beginning with December 1, however, the building was practically in use throughout all parts of it. The costs for fuel and power for the period from December 1 until the end of the school year were, approximately:

Coal	$646.00
Power	113.00
	$759.00

It may be of interest to note that $200.00 invested in soft coal would have bought just as many heat units as were purchased for $646.00 when buying hard coal.

So far as the writer can learn School No. 7 was never supplied with the full requirement of pure air, 30 cu. ft. per pupil, per minute, for but one day during the entire year of 1914-'15, and then, for only two hours in that day.

The contract under which the ventilating apparatus was installed in this building called for a motor-generator to be placed in the basement of the school house that should develop an electric current with an intensity of 110 volts.

The ventilating machines, situated one or more in each room, were to be operated by the current from this motor-generator.

After being installed this motor-generator was so controlled by a rheostat as to develop a much lower voltage. The apparatus was run at this lower voltage until the morning of February 25, 1915. Upon that date the inspector of the Education Department of the State of New York, made an official inspection of the ventilation of the school house.

The inspection began at 9 a. m. and was completed at 11 a. m. of the same day. During the two hours of this official inspection the motor-generator was developing a full 110 volts.

Soon after the inspection had been completed the motor-generator was again so controlled by the rheostat as to develop a much less intense current.

Lowering the voltage eventually lowers the work done by the ventilating machines situated in the school rooms.

Less work done, of course, means less cost to operate, and it also means that the pupils get a diminished quantity of pure air.

An increase in operating expenses, occasioned by rigidly insisting that a full supply of air be supplied to the school rooms, can be offset by a saving made in buying low-priced fuel and then burning it upon grates adapted to it.

From the fact that the boilers in this building are entirely new it is not likely there will be any change or other boilers in which soft coal can be burned without smoke.

In this building, as in No. 9 school, there is the problem of raising a large quantity of air from, say 10° below zero to 80°. In this building it is necessary to raise 1,760,000 cu. ft. of air 90°. In order to do this with 5 lbs. of pressure in the boiler 87 H.P. is needed. In addition to this it is necessary to have 44 H.P. to take care of the 3,683 sq. ft. of direct radiation in the school rooms and other parts of the building.

To provide this total of 131 H.P. there is a boiler plant that is capable of developing, at 5 lbs. pressure, 105 H.P.

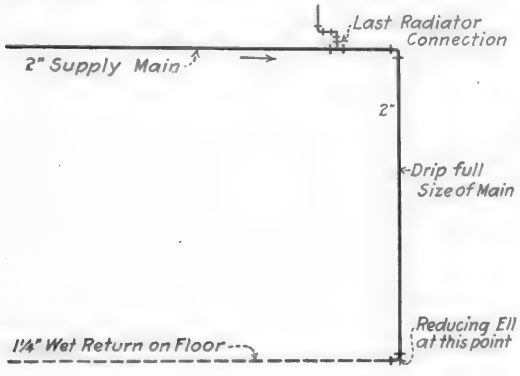
In order to meet with every requirement of the laws relating to ventilation there should be another boiler installed having at least 26 H.P. capacity.

Drips on Steam Piping

By H. S.

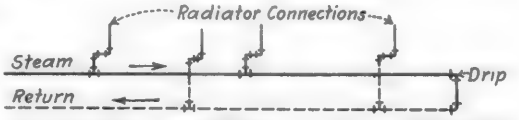
Much has been said and written about the piping of heating systems, but little about the importance of proper drip connections on them. Much trouble, time and expense could be saved if drips on steam piping of heating or drying systems, or wherever steam piping is used, were given the care in design and erection that they warrant.

It is surprising the numerous methods which are employed in dripping a one-pipe steam system. Naturally, most fitters drip the end of the main, differing only in size of drip pipe. The illustration below has been found to be the most successful for one-pipe systems having a wet return.



CORRECT METHOD OF DRIPPING STEAM MAIN IN A ONE-PIPE SYSTEM.

If a dry return system is used, it is customary to reduce the pipe size of the return two sizes. However, in either kind of one-pipe system, better results will be obtained by running the supply



INCORRECT METHOD OF DRIPPING STEAM MAIN IN A TWO-PIPE DRY RETURN SYSTEM.

main full size at least 1 ft. beyond the last radiator connection before dripping. This also applies in any type of steam-heating system.

The following method is one used frequently on one-pipe systems. The steam mains are pitched back to the boiler and are dripped at a point close to the boiler. This is not very satisfactory, unless the runs are very short or, if the runs are long, the pipe size must be materially increased in order to get good circulation.

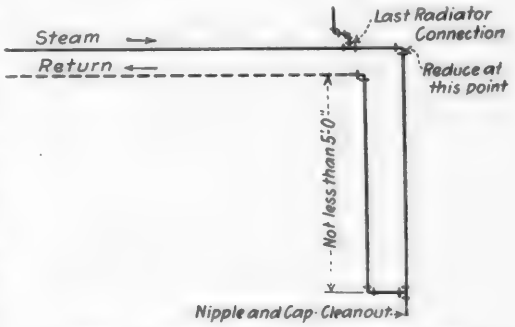
An erroneous but very common method of dripping the end of the main in a two-pipe dry return system is to connect the drip from the steam main directly into the return. Much better results are obtained by loop-sealing the drip before connecting it to the return, as shown by the sketch on next page.

The seal need not be the full size of the main, as a 1-in. pipe is amply large enough for a 2½-in. supply main with a 100-ft. run. This method has been found more successful than the common one, as it prevents the steam from blowing directly into the return without going through a radiator, thereby establishing a slight difference in pressure between the steam and return main, and consequently making a more positive flow through the radiators and minimizing the possibility of the radiators air-binding, which is ordinarily a frequent occurrence with this type of system.

The system of steam heating in which drips play a very important part is the air return or vapor system. In this improved type of steam system, which is very sensitive, the mains must be drained thoroughly at all times or the operation of the system will be affected, usually to a greater extent than an ordinary steam system. In this type of system, as in a single-pipe system, many methods are used to drip the steam mains. A separate drip main, connecting all the drip points and dropping wet at the boiler is required in some vapor systems. This is a very good method, but has the disadvantage of increasing the cost to some extent. Other manufacturers require a special vacuum valve on all drip points before connecting them to the return main. Loop-sealing the drip connection and placing a vacuum valve at the outlet of the seal, then connecting into the return main, is another method used by some concerns. However, probably the most satisfactory and economical way is to connect the drip through a 5-ft. loop seal into the return main.

Satisfactory results have been obtained by the use of all the above-mentioned methods, and all have the same objective, i.e., to pass the water of condensation in the supply mains back to the boiler without lowering the difference in pressure between the supply and return mains necessary for the successful operation of the system. The same variety of methods are used in dripping the mains in a mechanical vacuum system as are used in a gravity vapor system.

The common opinion that high-pressure steam mains do not require as careful dripping as low-pressure mains is incorrect. The reason for the common error is that in a high-pressure main the velocity is so much greater, and for that reason the condensation in a main which is not dripped correctly is carried along by the steam until a drip point is reached, or as in a great many instances where no drips at all are installed, the water is carried up with the steam to wherever the steam is used, in a radiator, cooking kettle or steam jacket. The expense of



CORRECT METHOD OF DRIPPING STEAM MAIN IN A TWO-PIPE STEAM SYSTEM.

operation can be lowered in a great many cases in plants where high-pressure steam is used extensively by the addition of drips at low points.

The work done by lifting the condensation by the steam and the additional condensation produced by the steam coming into contact with the cooler water could be eliminated. Most engineers think (if they give it any thought at all) that it does not amount to much, but in a year's time it grows to be a large item.

The Co-Efficients of Heat Transmission Established by the Austrian Engineers.

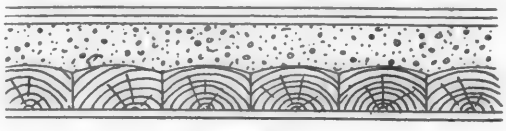
BY A. A. JONES.

(Abstract of paper presented before the Institution of Heating and Ventilating Engineers, in London, October 10, 1916.)

Editor's Note.—A paper on the Austrian heat loss co-efficients was presented at the 1908 annual meeting of The American Society of Heating and Ventilating Engineers, but, due to an error in translation, the figures were found to be nearly twice those ordinarily used in this country. The error was later discovered and the paper, as published in the society's proceedings, is in its corrected form. In the accompanying tables the co-efficient K is expressed in B.T.U. for a surface of 1 sq. ft. and 1° F. difference in temperature per hour.

The Austrian co-efficients of heat transmission were established with the greatest care and have been confirmed in practice. The author translated the figures of this document into B.T.U. literally, instead of rearranging the figures for British thicknesses, etc.

The author added that it was advisable to adopt the figures of some reliable authority as a temporary expedient, until the British society is able to set up some definite co-efficients, these latter to be arrived at by means of experiments and, of course, on British materials of construction. By the comparison of these figures with those of Rietschel and the German Union of Heating Engineers, a temporary set of co-efficients could be arranged for the British institution. Then, with the aid of Mr. Barker's promise to devote the laboratory at the University College to this work for making actual tests, the British engineers will be on the right road to enable them to ask architects and even the government to make the figures compulsory.



FIG·1

FIG·2

TABLE 1—HEAT TRANSMISSION THROUGH EXTERIOR WALLS.
(The co-efficient, K, is expressed in B. T. U. for a surface of 1 sq. ft. and 1° F. difference of temperature per hour.)

	Brick				Stone	
Thickness, Inches.	With covering inside and out.	Brick with plaster inside.	With air space of 2 ins.	With layer of plaster of 1 in. and air space of 2 ins.	Sandstone.	Limestone.
5.9	0.483	0.530	.....	0.249	.....	.....
11.8	0.319	0.347	0.276	0.198	0.585	0.645
15.7	.....	.....	.....	.....	0.512	0.562
17.7	0.243	0.262	0.198	0.163	.....	.....
19.6	.....	.....	.....	.....	0.452	0.497
23.6	0.194	0.206	0.167	.....	0.407	.0448
27.5	.....	.....	.....	.....	0.370	0.407
29.5	0.161	0.172	0.142	.....	.....	.....
31.4	.....	.....	.....	.....	0.339	.0374
35.4	0.139	0.145	0.120	.....	0.313	0.346
39.3	.....	.....	.....	.....	0.290	0.319
41.3	0.122	0.126	0.106	.....	.....	.....
47.2	0.114	0.116	0.194	.....	.....	.....

BRICK WALL WITH STONE FACING.

Thickness of the stone, inches.	Thickness of the brick-work, inches.	With lime-stone facing. K =	With sand-stone facing. K =
3.9	5.9	0.376	0.360
3.9	11.8	0.270	0.260
3.9	17.7	0.208	0.204
3.9	23.6	0.172	0.169
3.9	29.5	0.145	0.142
3.9	35.4	0.124	0.124
3.9	39.3	0.114	0.110
9.8	5.9	0.331	0.299
9.8	11.8	0.245	0.227
9.8	17.7	0.190	0.182

COMPRESSED CONCRETE WALL.

Thickness of wall, inches.	Solid concrete K =	Concrete with air space
7.8	0.501	0.309
11.8	0.432	0.280
15.7	0.378	0.256
19.6	0.335	0.237
23.6	0.303	0.219
27.5	0.276	0.204
31.4	0.253	0.192
35.4	0.233	0.180
39.3	0.217	0.172
43.3	—	0.161
47.2	—	0.153
51.1	—	0.147

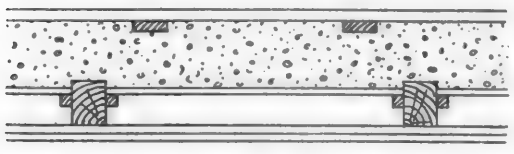


FIG. 3.

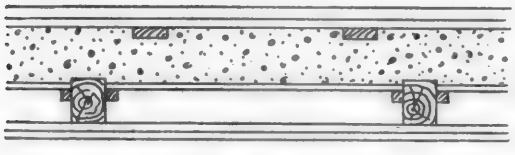


FIG. 4.

FIG. 5.

FLOORS AND CEILINGS.

Floor of wood bearers (Fig. 1) with plaster ceiling beneath, and pugging, battens and flooring above. K = 0.055.

Single wood floor (Fig. 2). K = 0.327.

Floor with joists (Fig. 3) having a layer of plaster, an air space, pugging and flooring. K = 0.1; K' = 0.049.* (K for cold air above and K' for cold air under the floor.)

Floor with joists (Fig. 4) having a layer of plaster, an air space, pugging, battens and flooring. K = 0.088; K' = 0.045.*

FIG. 6.

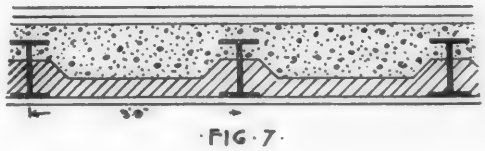


FIG. 7.

FIG. 8.

FIG. 9.

Reinforced concrete floor (Fig. 5) with battens and flooring. K = 0.239.

Reinforced concrete floor (Fig. 6) with battens and flooring and layer of plaster on metal lathing. K = 0.237; K' = 0.186.*

Reinforced concrete floor (Fig. 7) having a layer of plaster on metal lathing, the floor of ferro-concrete, properly so-called, pugging, battens and flooring.

*K for cold air above, K' for cold air under the floor.

TABLE 2—HEAT TRANSMISSION THROUGH INTERIOR WALLS.

Thickness, Inches.	Brick walls with covering.	Wood partition without covering.	Wood partition with covering each side.	Conglomerate cork wall.	Plaster slab wall.
0.59	.....	0.491	.....	.....	.....
0.78	.....	0.430	0.266	.....	.....
0.98	.....	0.409	0.245	.....	.....
1.18	.....	.....	0.225	.....	0.655
1.57	.....	.....	0.204	.....	0.616
1.96	.....	.....	.....	.....	0.593
2.36	.....	.....	.....	.....	0.573
2.75	.....	.....	.....	0.202	0.540
3.14	.....	.....	.....	.....	0.518
3.54	.....	.....	.....	.....	0.495
3.93	.....	.....	.....	.....	0.477
4.72	.....	.....	.....	0.116	.....
5.9	0.430	.....	.....	.....	.....
9.8	.....	.....	.....	0.059	.....
11.8	0.286	.....	.....	.....	.....
14.9	.....	.....	.....	0.041	.....
17.7	0.225	.....	.....	.....	.....
23.6	0.180	.....	.....	.....	.....
29.5	0.145	.....	.....	.....	.....
35.4	0.122	.....	.....	.....	.....

Joists, in Inches.	K.
6.2	0.147
7.0	0.137
7.8	0.124
8.2	0.120
8.6	0.116
9.0	0.114
9.4	0.110
9.8	0.108
10.2	0.106
11.0	0.098
11.8	0.092
12.5	0.090
13.7	0.081
15.7	0.075
17.7	0.073
19.6	0.071
21.6	0.057

Vaulting of masonry 5.9 in. without pugging:

	K.
With flagstone paving	0.339
With covering of asphalt	0.323
With covering of linoleum	0.331
With flooring on asphalt	0.286

Vaulting of masonry 5.9 in. with pugging.

	K.
With battens and flooring	0.067

ROOFS.

Reinforced concrete (Fig. 8) with layer of plaster on metal lathing, air space, reinforced concrete, pugging of wood sawdust and gravel pugging:

For joists 6.299 in. high and 2 ft., 6 in. to 3 ft. 9 in. wide	0.2
Reinforced concrete roof without air space (Fig. 9)	0.575
Roof with tarred paper on laths 0.984 in. thick	0.436
Zinc roof	0.444
Copper roof	0.444
Slate roof	0.430
Tile roof without laths	0.993
Roof of wood sawdust agglomerate	0.27
Corrugated iron roof	2.129

WINDOWS AND GLAZED LIGHTS.

Thickness of glass, Inches	Single windows.	Skylights.
0.039	1.101	....
0.078	1.095	....
0.118	1.087	....
0.157	1.081	....
0.196	1.073	....
0.236	1.067	....
0.275	1.058	....
0.314	1.052	....
0.354	1.046	....
0.393	1.038	....
Single glass	....	1.146
Double glass	....	0.481

REINFORCED GLASS.

Thickness of glass in inches	0.314	0.314	0.354
Width of the mesh in inches	0.393	0.196	0.236
Diameter of the wire in inches.	0.0314	0.0314	0.0393
K	1.052	1.05	1.146

DOORS.

Thickness of wood, inches.	Soft wood—Interior doors.	Soft wood—Exterior doors.	Hard wood—Interior doors.	Hard wood—Exterior doors.
0.787	0.440	0.487	0.606	0.684
1.181	0.355	0.387	0.512	0.587
1.574	0.301	0.323	0.466	0.518
1.968	0.260	0.276	0.419	0.483
2.362	0.229	0.239	0.380	0.419

Supplements to add:

For comencing the heating, 20% of the calculated quantity of heat is added in schools and public establishments, with daily heating; in residence work, 15%. In rooms provided with heating aparatus which has to heat not only the room but the incoming fresh air (heating at the windows with fresh air inlet) these supplements can be neglected.

For large-size rooms and rarely used, it is necessary to make a special calculation, as follows:

For the absorption of heat by the solid masonry it is necessary to allow that it penetrates to an internal thickness of 4.7 in. at the temperature of the room.

According to the formula:

$$Wa = GS\ (T-t) \frac{1}{z} \text{ in B.T.U., in}$$

which

G is the weight in pounds of the part of the wall 4.7 in. thick.

S is the specific heat of the materials of construction.

T is the temperature to be attained in the room.

t is the initial temperature.

z is the number of hours allowed to attain the desired temperature.

For the loss per hour of heat by the walls, the windows, the floor and the ceiling, the following formula is used:

$Wt = FK\ (T - t)$ in B.T.U., in which F is the surface in square feet of walls, windows, etc., of the room and K the co-efficient of heat transmission.

For heating the air of the room, the following formula is applied:

$$We = 0.24L\ (T - t) \frac{1}{z} \times 0.0807 \text{ in}$$

B.T.U. in which L is the volume of the room, 0.24 the specific heat of the air.

ALLOWANCES TO BE MADE FOR DIFFERENT EXPOSURES.

The situation to the north requires a supplement of 29%; to the east and west, 15%; to the south, 0%. For the intermediate situations intermediate figures are taken.

WIND ALLOWANCE.

It is necessary to add 10% for the surfaces particularly exposed to the wind.

HEIGHT OF ROOMS.

The influence of the height of the rooms ought to be taken into account for the rooms of more than 13 ft. high by adapting an interior temperature increasing with the height of the room. By allowing T as the temperature to obtain at the height of the head, the following formula is used:

$$T' = T + 0.014\ T\ (H - 9.84).$$

in which T′ is the temperature at the ceiling, and H the height of the room in feet. The temperature to adopt in the calculations will be $(T' + T) \div 2$.

TEMPERATURE ALLOWED FOR THE ROOMS NOT HEATED.

	Deg. F.
Closed room not heated, placed between two heated rooms	41
Closed room adjacent to a heated room	32
Cellar	32
Room not heated often connected with the exterior (vestibule entrance)	23
Ground floor without basement under	32
Attic under metal or slate roof	14
Attic under concrete, tile or paper roof	23

It is necessary to determine the temperature of a room not heated, by considering the heat absorbed or stored by the walls, windows and ceilings.

MEASUREMENTS OF THE VERTICAL COOLING SURFACES.

The measurements to be considered in the calculations are the distance from side to side of the walls by the height or the distance from the floor to the ceiling.

For the windows and doors it is necessary to take the net opening of the brickwork. The surfaces of the windows and the doors are to be deducted from the walls.

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A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

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IF ASKED to name the three most important developments in the heating profession during recent years we should list them in the following order: 1. Better technical training; 2. The rise of the engineering catalogue; 3. The development of salesmen engineers. Of these three it must be frankly admitted that the advance in technical training has made the poorest showing, and, for that reason, we believe that more than a casual study should be given to the recommendations presented on another page of this issue concerning "What Can Best Be Done to Advance the Interests of the Engineering Profession in the United States." This paper supplements, in an interesting way, the recent survey conducted by the Chemical Engineers' Society, and on many points, reaches the same conclusions. Much has already been said on this subject, so that it is unnecessary at this time to do more than call renewed attention to the crying need for more and better opportunities for the young heating engineer to acquire what has been tartly described as the "inside dope."

FAR MORE encouraging is the advance shown in the development of the engineering catalogue, which has now assumed a commanding position in the field of trade literature. The recent appearance, for instance, of two fan data manuals, together with newly-issued "bulletins" on humidifying and air conditioning in general, furnish convincing proof, if any were needed, that the bombastic, "best-ever" claims of the old line catalogues have given way for good to the convincing performance-data arguments of the modern catalogue. In fact, it may well be asked whether the modern engineering catalogue is not the answer to the demand for more practical sources of information than are afforded by the ordinary hand-books. There is no denying that there is such a demand, especially when it is considered that in one city alone a class of eighty young men actively engaged in the profession may be found enrolled for night study of the art of heating and ventilation.

Finally, there is the recognition of the fact that the salesman of the future in any mechanical trade must be an engineer. The day of the smooth-spoken, but uninformed, "good fellow" is inevitably passing in favor of the man who can talk to his client in his own language and confer with him on his particular use of the product in question.

As a result of the developments cited, the heating profession is advancing more rapidly, perhaps, than any other, and while the young engineer is being urged and pleaded with to do his share towards the up-building of the profession, such as taking more interest in his chapter or other association interests, there is even greater need of warning him that he is likely to be left in the ruck if he fails for a minute to keep up with the significant movements now going on in his field.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

Conducted by Ira N. Evans.

66—Heating With Exhaust Steam From Steam Hammers.

QUESTION: The writer has a proposition of laying out and installing a heating system where it is intended to use the exhaust steam from steam hammers. I would like to know what is the most practical method of measuring and how to arrive at a proper charge; that is, whether it is best to make a charge on a B.T.U. basis or for the condensation returned.

ANSWER: This question involves many points not stated. The writer will try to answer the question in several ways, hoping a suggestion may be obtained as to the proper course to pursue.

It is not clearly indicated, for instance, whether it is desired to measure the entire amount of steam used by the hammers or only that portion used for heating. In utilizing steam from steam hammers it should be recognized that they are very intermittent in operation; that is, they will exhaust a large amount of steam for a short period and then be idle for an equal interval. Where the heat required for heating is a comparatively small portion of the maximum output, the flow would be comparatively steady, or where the hammers were in sufficient number, the fluctuations of the whole would not be so great.

Where there is a fluctuating power load, there will be a certain amount of live steam used to maintain a constant pressure and some steam will be lost through the back pressure valve. It is of vital importance that the back pressure on the steam hammers be constant, so as not to interfere with the operation of the hammer. If the back pressure varies between fairly wide limits, the operator cannot tell how wide to open the throttle to deliver blows of proper intensity. In some plants the operators will not permit any back pressure at all, due to the variations on the exhaust side of the hammer.

It is also to be remembered that, due to the resistance and variable back pressure, more steam will be used by the hammers than if they were exhausting free, without any back pressure.

If it is desired to measure the steam for both hammers and heating, a steam flow meter should be used, placed in the high pressure line. Such a meter should be of the integrating type and, if your pressure conditions are nearly constant, fairly accurate results can be obtained. If it is desired to measure only the heat used by the heating system, a condensation meter, with proper cooling coil and trap, should be adopted. The latter, however, will not take account of the extra steam used by the reducing valve or that wasted through the back pressure valve during periods of light and peak loads.

If both flow meter and condensation meter are used and the extra live steam due to back pressure, etc., is determined with the heating on and off, one can obtain a very fair estimate of the steam used. If by a B.T.U. rate a flat rate is meant, the writer does not believe this would be equitable either to the seller or purchaser.

Another method is to place the flow meter on the live steam connection to the heating system only and, with the condensation meter, the total steam required for heating will be obtained. This would not, however, show the increased steam due to the back pressure.

The relative amounts required for heating and the steam available from the hammers will be the determining factor. With a given back pressure the increased steam consumption will be nearly constant for each size machine, and may possibly amount to very little.

The increased steam consumption on hammers, due to back pressure, and all live steam used to maintain the pressure constant, should all be charged to the heating. When the total pounds of condensation are determined from the meters, there should be subtracted the heat in the liquid as it goes to the sewer at, say, 200° F., which is 168 B.T.U. per pound, from the total heat in the steam at the pressure at which the back pressure valve is set, say, 5 lbs., or

1,158.8 B.T.U. There will then be condensed in the heating system 988 B.T.U. per pound of condensate.

The live steam, however, should be taken at the pressure outside the reducing valve before entering the system. If, for instance, it is 80 lbs. gauge, or 1,185.4 B.T.U., the heat value per pound will be 1,185.4 — 33 = 1,152 B.T.U. for all steam passing through the flow meter to the system.

In case the conditions are different from those cited above, the proper quantities can be looked up in a steam table and proper determination made. If no return condensation gets back to the plant, the heat used on the system should be calculated from the initial feed water temperature to the final pressure at the reducing valve.

67.—Figuring Heat Output of Copper Coil Heaters.

QUESTION: There seems to be a teendency to use copper coil heaters, designed for storage tank purposes, for heating small houses. In your opinion is this economical, as compared with the regular cast-iron gas heaters of the Simplex or Bryant type? Also, what would be a fair estimate of the number of B. T. U. that could be transmitted through the tubing to the water? In checking over several heaters I find that in some it is as low as 3,000 B. T. U. per square foot of tubing and in others as high as 10,000 B. T. U. per square foot.

Take, for instance, a certain storage heater containing 200 lin. ft. of ¾-in. copper tubing that, when used as a house heater, has a rating of 1,600 sq. ft. of radiation.

1 lin. ft. of ¾-in. tubing has 0.201 sq. ft. of surface.

200 × .201 = 40.2 sq. ft. of heating surface.

1,600 × 250 = 400,000 B. T. U. capacity of heater.

400,000÷40.2=9.950 B. T. U. per sq. ft. of tubing.

Its storage heating capacity is listed at 6 gal. per minute. It will require approximately 1,170 B. T. U. to heat 1 gal, of water per hour through 140° F., say, from 40° to 180° F. 400,000÷1,170 = 342 gal. of water per hour. 342 ÷ 60 = 5.7 gal. per minute, which is a trifle less than its listed capacity.

If natural gas is used to do the heating and we allow 900 B. T. U. per cubic foot for the gas, it will take 400,000 ÷ 900 = 444 cu. ft. of gas per hour and will cost 444 ÷ 1,000 × 30 cents = 13.3 cents per hour when running at full capacity.

ANSWER: As far as economy is concerned, we would say that if the heating surface is efficient and sufficient, in proportion to the gas burned, it would make little difference as to the form of heater. When extracting heat from hot gases, the free movement of the water on one side and the hot gases on the other are all that govern the rate of transmission, the temperature difference being the same.

The only comparison the writer has to go by is the transmission as shown by our correspondent's figures of 9,950 B. T. U. per square foot per hour, and if there were 800° F. average temperature difference between the water and gas, it would mean a transmission of 12.5 B. T. U. per degree difference per hour. This has been equaled by fan coils, in some cases, of high velocities and wide differences in temperature, as with high pressure steam.

In calculating the cubic feet of gas, with 900 B. T. U. per cubic foot, nothing has been allowed for the heat lost in the products of combustion which would surely amount to a great deal proportionately, under the conditions assumed. The economy of operation of such a coil, if the heating surface is short, is reduced, but the capacity can be maintained by burning more gas and allowing the products of combustion to pass off at higher temperatures.

The process is analagous to that in a house heating boiler when the heating surface is short. By maintaining a high flue temperature and a high rate of combustion, the capacity can be maintained within fairly wide limits by burning more fuel at the expense of economy.

The writer would suggest that our correspondent connect up one of these gas heaters with a range boiler, the capacity of which can be easily determined. Place thermometers on the water inlet and outlet, and shut off all lines to the house. Place another thermometer on the outlet of products of combustion of the heater, also shut off all gas to the rest of the house and read the meter before starting and after completing the test. The temperature of the products of combustion will give the loss in the flue, and the time to heat the boiler to temperature (shown on outlet and inlet water thermometers) will give the work accomplished in the interval of time for the cubic feet of gas, as shown by meter readings.

By regulating the rate of flow of gas it will be easy to determine the most economical capacity and combustion rate for any given amount of heating surface in a heater. If these results are plotted in a curve, it will be possible to find the most economical method of operating the heater. This experiment can be arranged at slight expense in almost any house having street gas and city water. The results might not be absolutely accurate, due to the radiation of the

surface of the range boiler, if not covered, but by testing two heaters of different types with the same readings on the water thermometers, a fair comparison could be made.

Maintaining a Running Balance in High-Speed Machinery.

The importance of running balance in high-speed machinery is well understood. Under the title of "Dynamic Balance," a paper on this subject was recently presented before the American Society of Mechanical Engineers, by N. W. Akimoff, engineer for the Dynamic Balancing Machine Co., Philadelphia, Pa.

In this paper Mr. Akimoff described a machine which he has devised for correcting the condition of dynamic unbalance. This is a matter of importance, not only in power plants, but in all hotels, hospitals, etc., where the annoyance due to unbalanced machinery is often serious. Such machinery may include turbines, centrifugal pumps, electrical apparatus, etc., as well as fans and blowers.

After discussing the principles involved Mr. Akimoff stated that a machine to deserve the name of dynamic balancing machine must indicate the plane of unbalance, as well as the numerical value and sign of the unbalancing couple. In the machine illustrated herewith he claims to have produced such a device.

A rigid horizontal beam (Fig. 1) is hinged at one end and supported by a spring at the other. The body to be tested, already in perfect static balance, is rotatably supported on the beam. If dynamically unbalanced the body will, when rotated, cause the beam to vibrate in a vertical plane,

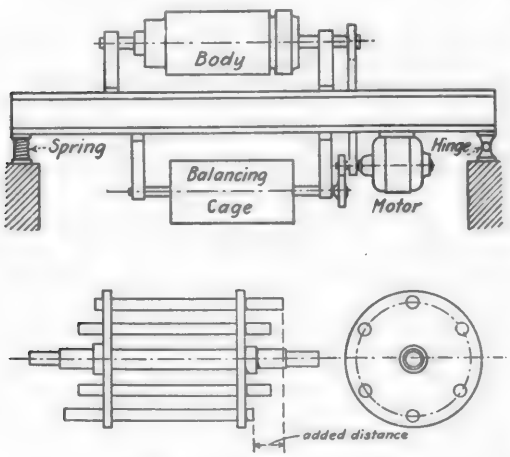


FIG. 1—CONSTRUCTION OF SQUIRREL CAGE.

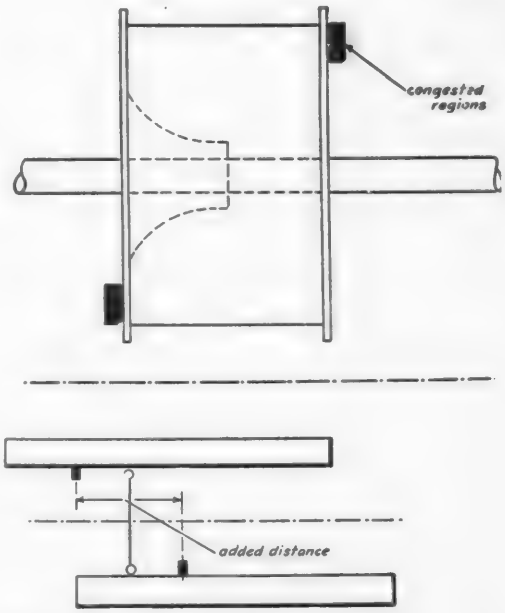


FIG. 2—DYNAMIC UNBALANCE IN SPECIAL FAN.

with a period of oscillation equal to the period of rotation of the body. In other words, if the speed of the unbalanced body is, say, 315 R.P.M., the beam will vibrate at the rate of 315 complete oscillations per minute, quite regardless of the characteristics of the spring (except possibly at the very beginning of motion).

Now imagine a second body, exactly similar in every respect to the first, also in perfect static balance, but dynamically unbalanced to precisely the same extent as the first body, temporarily associated with the same beam, say suspended under it.

If these two bodies are oppositely located as to balance and run precisely at the same speed (synchronously), then the unbalancing or disturbing couples will cancel out, and the beam will have no tendency to vibrate, no matter how badly unbalanced, individually, are the two bodies. This is the fundamental principle of the machine, to determine unbalance by determining the unbalance necessary to neutralize its effect.

In the actual machine, instead of a second body being an exact image of the original unbalanced body, it is a so-called squirrel cage, and this is rotated in unison with the article to be tested. This cage (Fig. 2) consists of two or more circular discs, carrying an even number of rods, usually six or eight, arranged slidably in the discs. The rods are accurately made and their common weight is known; therefore, any displacement of one of the rods with respect to the one directly opposite will not

affect the static balance, originally perfect, of the cage, but will introduce a certain centrifugal couple, according to the relative displacement of added distance.

For instance, suppose that the unbalanced body is a special fan, Fig. 3, and that the unbalance is due to two excess weights, grossly exaggerated in the figure. This will result in a centrifugal couple, and to counteract it, the cage will have to be put into a state of unbalance, as shown by the relative displacement of the rods and as measured by the added distance.

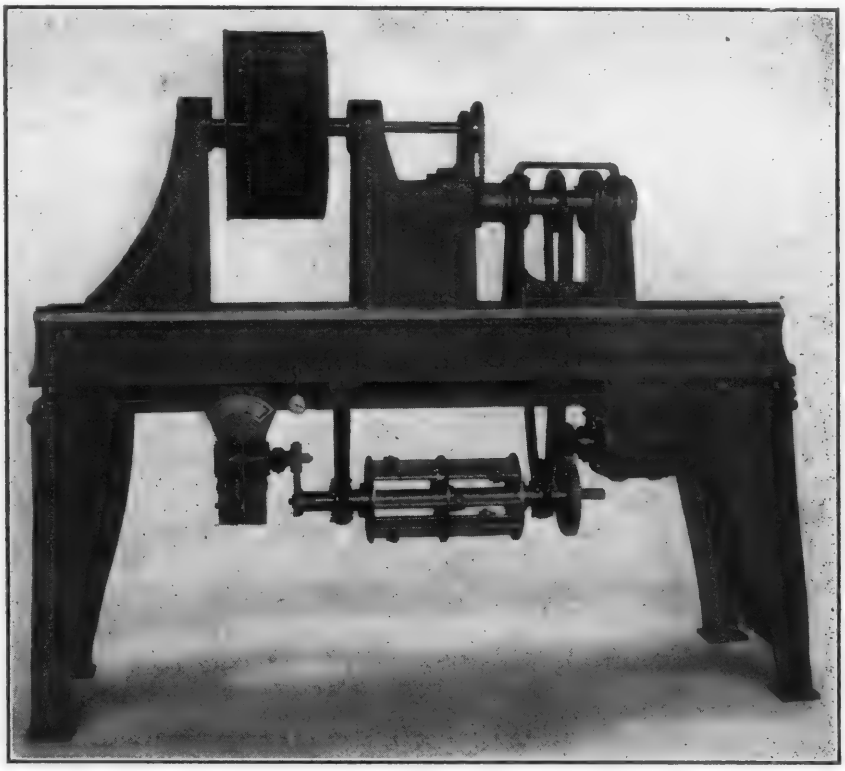


FIG. 3—DYNAMIC BALANCING MACHINE, BALANCING SPECIAL BLOWER.

Thus the cage has means for indicating the exact amount of unbalance which has been put into it in order to reproduce with the opposite sign the exact unbalance of the article being tested. For instance, the displacement or added distance of 15-16 in. may represent (for a certain speed) a couple of, say, 120 oz-in. The plane of unbalance is easily established by the location of the two rods, the moving of which into a new position stops the vibrations; and the value of the couple is immediately given by the added distance.

It should be clearly understood that the centrifugal couple due to the body acts upon the beam in a simple harmonic manner, that is, according to the law of sines; but so does the effect of the balancing cage. In other words, when the axial plane of unbalance is vertical, the effect of unbalance on the hinged beam is the greatest, as also is the effect of the correcting element, the cage.

When the plane of unbalance is horizontal, that of the correcting element is likewise horizontal, since the cage and the body rotate in unison, and neither is in any manner felt by the beam which does not respond visibly to any but vertical efforts or the vertical components of other couples.

So far as the spring (Fig. 1) is concerned, its object is to intensify the amplitude of the vibrations, although an unbalanced body will always cause the whole bed to vibrate with a frequency corresponding to the speed of the body.

However, there is an additional advantage in the use of the spring, as it is always possible to select the characteristics of this so that, under its load, its free period of oscillation will correspond exactly to the rate at which it is desired to run the test.

Such a synchronism has a large magnifying effect, so that even a slight unbalance results in a considerable amplitude of oscillation.

Public Service Commission Rulings on Central Station Heating

Recent Commission Rulings As to Heating Service.

The Idaho Commission in re Great Shoshone & T. F. Water Power Co. Case No. 112, Order No. 269, August 26, 1915, approved a form of application for and rules and regulations governing electric air heating service.

In the Cleveland Electric Illuminating Co., No. 603, September 29, 1915, the Ohio Commission found that certain additions and extensions to the distributing plant of a light, heat and power company required by the ordinance of a city were reasonable and necessary to the interest of the public, and should be made, and ordered that the company make such additions and extensions to its distributing plant as might be necessary to furnish a new city building with an adequate supply of heat, upon condition that the city obligate itself to accept and use the service for a period of not less than ten years.

The Wisconsin Commission holds that a public service corporation will not be allowed to discontinue heating service to certain patrons on the theory that topographical conditions render it impossible for the company to furnish such service where it appears that satisfactory service was formerly rendered and that the company is about to enlarge certain of its mains which may result in materially improving the service on the lines in question; but if experience should demonstrate that, with increased main capacity, it is impracticable to render adequate service on any part of the system, the matter will be fully considered upon petition. La Crosse vs. Wisconsin-Minnesota Light & Power Co. The company was required to pay for changing from a pneumatic to a hydraulic system of heating regulation in cases where the owner had already paid for the penumatic installation.

It was also held in that case that a company supplying heat to its customers should have the right to determine the amount of square feet of radiating service, the size of the supply pipes, the location of radiators and piles and, in general, should either install all service or approve plans when the work of installation is performed by other persons. Valves connecting mains with service installations should be under the control of the company, and kept locked by it.

Commission Rulings as to Heating Rates.

The following orders relating to heating rates have been recently made by the Indiana Public Utilities Commission:

In re Central Heating Company, No. 1770, Sept. 24, 1915, the commission approved a flat heating rate of 14.60 cents per square foot of required radiation for heating season of seven months for office buildings of specified steel and concrete construction, having specified heating equipment and subject to various regulations.

Re Interstate Pub. Service Co., Nos. 1820, 1821, Oct. 7, 1915. An order was made permitting the words "except that all radiation installed by the consumer in addition to that required by the formula will be charged for," to be stricken from the rules of the company governing heating service in the towns of Lebanon and Fowler.

Jurisdiction Over Steam-Heating Companies.

Steam heating appears to have been withheld from the jurisdiction of the Colorado Commission under the public utilities law of that state, and for this reason the Commission holds that it is without power to adjust the rates of the steam-heating department of a utility. The statute enumerates all the utilities which shall be under the jurisdiction of the Commission, and steam heating is not named among them.—Re Colorado Springs Light, Heat & Power Co.

Increase of Rates for Hot Water Heating Service.

On petition for authority to increase rates for hot water heating service in the city of Peru, Indiana, an order of the Commission authorized an increase of rates from 20 cents to 25 cents per square foot of radiation on the basis of an installation of 91,500 sq. ft. This action was taken after the Commission

found that the valuation of the plant and intangible properties was $50,000, and the operating expenses and taxes, $17,800. The Commission also directed the company to set aside a depreciation fund of 2 per cent. annually, on the value of its plant and intangible properties until the further order of the Commission.—In re Peru Heating Co.

Rate of Depreciation—Hot Water Heating.

In fixing the rates for hot water heating service, the Indiana Commission holds that an allowance of 3% on the total valuation of the utility for straight line depreciation and 2% on the sinking fund basis was reasonable where it appeared that the life of the distribution system was estimated at twenty-five years, the plant equipment estimated to be in 50% condition after thirteen years' use, and the buildings estimated at 90% condition.—Re Peru Heating Co.

New Rate System for Central Station Steam Service.

A new system of charging for steam heating service has been established by the Rochester Railway and Light Co., Rochester, N. Y. It is described by R. D. DeWolf, of this company, who designed it, as a base steam rate system, on which all gross steam bills are figured. This is essentially a step-by-step rate, varying from a consumption of 5,000 lbs. per month up to over 2,000,000 lbs. per month. The form of this rate is published in the Bulletin of the National District Heating Association for October and is as follows:

First 50,000 lbs. per month @ A c. per 1,0000 lbs. per month.

Next 50,000 lbs. per month @ B c. per 1,000 lbs. per month.

Next 200,000 lbs. per month @ C c. per 1,000 lbs. per month.

Next 1,700,000 lbs. per month @ D c. per 1,000 lbs. per month.

All over 2,000,00 lbs. per month @ E c. per 1,000 lbs. per month.

It is evident that for any given consumption per month, the gross steam bill can easily be determined.

Any steam customer who is also an electrical customer will be allowed a rate reduction depending upon the kw. hr. used by the customer. For each kw. hr. used, fifty pounds of steam will be allowed at the rate shown in the reduction table, up to and including the total amount of estimated or metered low pressure steam. The total amount of reduction allowed for the total steam equivalent to fifty times the kw. hr., will then be deducted from the gross steam bill, leaving the net amount due the company.

The reduction table is as follows:

First 1,000,000 lbs. per month @ F c. per 1,000 lbs.

All over 1,000,000 lbs. per month @ G c. per 1,000 lbs.

For the sake of illustration, assume that the customer uses 500,000 lbs. of steam in a given month and 2,000 kw. hr. His bill would then be made up as follows:

50,000 x A =.....	.....
50,000 x B =.....	.....
200,000 x C =.....	.....
200,000 x D =.....	.....
Gross steam bill.....	.....
Reduction = 2,000 x 50 x F =....	.....
Net steam bill.....	.....

The above rate system is, of course, an approximation. No attempt has been made to include the maximum demand factor in this. As the art develops, means of measuring such a maximum demand may be developed to meet conditions, but at present the difficulties involved in getting such data on a commercial scale are prohibitive. This rate is, however, an attempt to correlate the steam and electrical demands of the customer and give him the advantage of such correlation. The unit prices have not been given in the above tables, as they are so largely dependent upon local conditions and might be very misleading.

NATIONAL DISTRICT HEATING ASSOCIATION

Plans for 1917 Convention.

The mid-year session of the executive committee of the National District Heating Association was held at the office of Secretary D. L. Gaskill, in Greenville, O., October 27-28. The committee favored Detroit, Mich., as the place for holding the 1917 convention and tentatively selected three days in June as the time. The committee also outlined the plans for that meeting. Owing to the quantity of matter which will be on hand, including reports of the standing committees, it is probable that a four-day convention will be necessary to adequately handle the subjects.

Meeting of Research Committee.

The research committee, apointed to work in conjunction with a similar committee from the New England section of the National Electric Light Association, met at Niagara Falls, August 25, and its report

will be presented at the next meeting of the National District Heating Association. The district heating association was represented by D. S. Boyden, Boston; George W. Martin, New York; S. Morgan Bushnell, Chicago; and R. D. DeWolf, Rochester, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New Officers Nominated.

The following nominations have been made by the nominating committee of the society, the election being by mail ballot and the result announced at the annual meeting in January:

For president, J. Irvine Lyle, New York.

For first vice-president, Arthur K. Ohmes, New York.

For second vice-president, Fred. R. Still, Detroit, Mich.

For treasurer, Homer Addams, New York.

For members of the council: Davis S. Boyden, Boston, Mass.; Bert C. Davis, Newark, N. J.; M. W. Franklin, Bloomfield, N. J.; Charles A. Fuller, New York; H. M. Hart, Chicago; Dr. E. Vernon Hill, Chicago; J. M. Stannard, Chicago; and Walter S. Timmis, New York.

New York Chapter.

New York heating engineers started their fall activities with a meeting of the New York Chapter, October 16, in the rooms of the Building Trades Club. The meeting was a get-together dinner, and was followed by a stereopticon lecture on "Spots of Revolutionary History," by Frank K. Chew. Before Mr. Chew was introduced, President Arthur Ritter, of the chapter, drew attention to the program which had been prepared for the winter and then called on M. W. Franklin, who urged that the members make a concerted effort to arouse the interest of all connected with the heating trade in the coming chapter meetings.

The chapter programme contains the announcement that Secretary C. W. Obert, of The American Society of Heating and Ventilating Engineers, has volunteered to assist in the secretarial work of the chapter.

The succeeding meetings will be in the hands of special committees, made up of eleven members each, with the exception of the January meeting, which will be merged with that of the annual meeting of the society.

The chairman for the November meeting is A.. M. Feldman; December, Homer Addams; February, J. Irvine Lyle; March, D. D. Kimball; April, Dr. M. W. Franklin; May, George W. Martin.

For the November meeting, which will be held at the Employers' Trades Club, 31 West 31st street, New York, November 20, a treat is promised in the form of a lecture on a new type of vacuum steam heating system. This system, it is stated, operates without air valves on the radiators and without traps on the return lines. It will be described by the inventor, Charles A. Ball, of New York. Special efforts are being made to secure a large attendance at this meeting, as it is believed data will be presented, not only by the speaker of the evening, but in the ensuing discussion, that will be well worth obtaining.

Illinois Chapter Elects Officers.

New officers were elected as follows at the annual meeting of the Illinois Chapter, which was held October 9, at the Morrison Hotel, Chicago: President, Fred. Powers; vice-president, Dr. E. Vernon Hill; secretary, A. E. Stacey; treasurer, August Kehm. Board of Governors: E. L. Hogan, J. F. Tuttle and G. W. Hubbard.

A report of the auditing committee showed a balance on hand of $183.66. A letter was read from Secretary Obert, of the heating engineers' society, proposing an exchange of papers between the chapters.

A number of suggestions was made for topics of discussion at future meetings, such as hot water vs. vapor heating, air movement through inlet registers, and descriptions and installations such as those in the C. B. & Q. Building, in Chicago and in the Real Estate Trust Building, in Philadelphia.

The following new members were elected: J. Cutler, J. C. Hornung, Lloyd Howell, J. G. Keleher, F. Lautenschlager, C. T. Morse and F. P. Keeney (associate).

Massachusetts Chapter.

The November meeting of the Massachusetts Chapter will be held at the City Club, Boston, November 14, when an address will be given by William C. McTarnaham, vice-president and manager of the Fess Rotary Oil Burner & Liquid Fuel Co., of Providence, R. I., on "Oil as Fuel, Its Uses, Its Various Methods of Application, Etc."

Autumn Meeting of British Heating Engineers.

A paper on "The Coefficients of Heat Transmission Established by the Austrian Engineers," by Alcwyn A. Jones, was the principal item on the programme for the

autumn meeting of the Institution of Heating and Ventilating Engineers, which was held at the Holborn Restaurant, London, October 10, 1916.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Master Steam Fitters Favor Arbitration in Labor Disputes.

In connection with the recent dispute between the railroad workers and their employers which was settled by the passage of the so-called Adamson "eight-hour law," the National Association of Master Steam and Hot Water Fitters went on record, through its board of directors, as favoring arbitration in the settlement of the dispute. In a telegram dated August 26, 1916, before the passage of the new "eight-hour law," the directors sent the following telegram to President Wilson:

"We strongly urge that the present dispute between the brotherhoods and railroads be settled only by arbitration. Newspaper reports would indicate that the enforcement of the so-called eight-hour day as demanded by the brotherhoods will result solely in an increase of about 25% in their daily rate of wage. It seems absolutely unjust that such a demand entailing an expense of many millions of dollars should be forced on the railroads without the question being referred to arbitration. Submission by the railroads would unquestionably result in a similar demand by all the other employees of the railroads with a perfect right to anticipate a similar forced settlement.

"If the brotherhoods are sincere in their demand for an eight-hour day why should they not accept the principle of such a day at the same hourly rate of wage as at present and leave to arbitration whether they should receive for that shorter day the same wage as for the longer day? We feel that the settlement of this question without arbitration will injuriously affect the relations of workmen and employers throughout the entire country."

Area of Cylindrical Pipes or Ducts.

Here is a chart that will be found handy for determining the radiating surface of all kinds and sizes of pipe; the heating surface of boilers, tubes, superheater flues and condenser tubes; the square feet of surface of refrigerating coils; and the square feet of metal needed for circular ventilating and heating ducts.

In fact, wherever it is desired to find the area of a cylindrical structure of the shape of a common pipe, this chart will give the answer quickly and accurately.

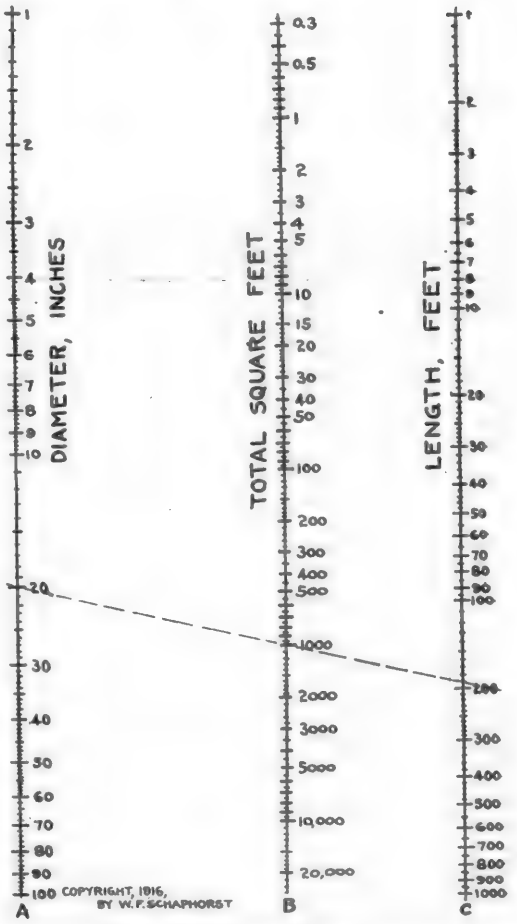


CHART FOR DETERMINING AREAS OF CYLINDRICAL PIPES FOR DUCTS.

As will be noted, the range of the chart is very wide, from 1-in. to 100-in. diameter measurement, and from 1 to 1,000 ft. lineal measurement. The dotted line drawn across the chart, for example, shows that where the diameter is 20 in. and the length 191 ft., the total area is 1,000 sq. ft.

The chart may also be used "backwards" to advantage. For example, if any figure in column C is known, and the total radiating area in column B is known, a straight line through the two poins will give the correct diameter in column A.—W. F. Schaphorst, M. E.

National Founders' Association will hold its twentieth annual meeting in New York, November 15-16, 1916, with headquarters at the Hotel Astor. The convention banquet will be held Wednesday evening, November 15.

The Smokeless Boiler Number.

Editor HEATING AND VENTILATING MAGAZINE:

You are certainly to be congratuated on the educational value of your October smokeless boiler number as regards the direction that the heating boiler is drifting, faster even than the smokeless boiler manufacturers themselves perceive.

The average heating boiler has been so wasteful, approximating under 50% rather than over 50% efficiency, which is becoming apparent to owners by comparison, that the manufacturers absolutely have got to make changes in their apparati, by adapting boilers to cheaper fuel, making furnaces and flues so that the combustion can be better and last, but most important, making grates less wasteful and more fool-proof, because at this point in most heating apparatus is where a tremendous waste into the ashpit is going on continually.

It is my opinion that in ten years from now you will be very well satisfied with what you added at this time to the trade literature on smokeless boilers.

HOMER ADDAMS.

New York, October, 1916.

Figuring Duct and Flue Sizes.

Editor HEATING AND VENTILATING MAGAZINE:

In THE HEATING AND VENTILATING MAGAZINE for October there is an article entitled "Comparison of Various Methods of Figuring Duct and Flue Sizes." The article is readily comprehensible to me, with the exception of a portion of the table at the top of page 34.

I can follow this table with the exception of the last two columns, or, rather, either of the last two coumns. I do not see how the actual duct area or duct size was derived from the equivalent number of 1-in. pipes. I can see, of course, and understand that the various ducts are not directly proportional to the equivalent number of 1-in. pipes, and if you would give me the necessary formula for use in this casee, or the usual method of computation, I should be much obliged. P. A. L. F.

Portland, Me.

REPLY BY HAROLD L. ALT.

The two columns referred to cover the size of duct and the area in square inches when the equivalent number of 1-in. pipes (as shown in the preceding column) is known. The last column is, of course, only a multiplication of the duct dimensions given and what our correspondent evidently wants to know is how the equivalent numer of 1-in. pipes is transposed into a duct size.

This is done by means of a table of equivalent numbers of 1-in. pipes which is commonly termed an "equalization table." This table applies either to round or square ducts, the diameter of the round duct or the side of a square duct being used as a basis. In principle the idea is that a certain amount of air passing through a 1-in. square, or round, pipe, at a certain velocity, will produce a given friction per unit of travel. Now twice this quantity of air passing through a duct equal to two 1-in. pipes will not produce a similar friction loss per unit of travel, owing to the lesser amount of skin friction; therefore, to produce the same friction loss per unit of travel the velocity must be increased until the friction reaches the original amount. The formula on which this is based is

N equals $\sqrt{\left(\frac{A}{b}\right)^5}$

When A equals the diameter of the round (or the side of a square) duct.

b equals the diameter of the round (or the side of a square) but smaller duct.

N equals the number of smaller pipes of equal carrying capacity.

A very complete table worked out from this formula is given in "Trautwine's Pocketbook" under the "Square Roots of Fifth Powers." Part of the table is given herewith:

Large Duct.	Equivalent 1-In. Pipes.	Large Duct.	Equivalent 1-In. Pipes.
1	1	14	733
2	5	15	871
3	15	18	1374
4	32	20	1788
5	60	24	2821
6	88	30	4929
7	129	36	7776
8	181	42	11432
9	243	48	15963
10	316	54	21428
11	401	60	27886
12	498	66	35388
13	609	72	43988

It must be understood that in using this table either square or round pipes may be used, provided that the computation is carried all the way through as square pipes or as round pipes, but they are not interchangeable in the same calculations. If, however, a change is desired in the sectional shape as, for example, in a duct system sized on the basis of round pipes where it may be required to transform to a square section, the diameter of the round pipe will be 10% in excess of the side of a corresponding square pipe and the diameter for a round pipe is computed and then divided by 1.10 to obtain the side of the equivalent square duct.

Similarly, in a system sized on a basis of square pipes, a change to round form can be made by computing the side of the square duct and then multiplying by 1.1 to get the diameter of an equivalent round duct.

Theory of the Brasher Air Breakwater.

A peculiar phenomenon illustrated by the Brasher air breakwater has been called afresh to the attention of engineers by a correspondent of The Engineer, of London, who writes in that journal:

"As the propagation of waves has been of some interest and study to me I would like to suggest that the theory on which Mr. Brasher has originated his breakwater has a simpler basis than that offered, at least, if my theory of wave action is fairly correct. The theory I put forward is based on certain experiments which I hereinafter describe, as well as on the known effects of air currents on aeronautic planes.

"My theory is that a current of air of sufficient velocity, passing over a rounded surface, causes a slight increase of pressure above the atmosphere on the windward side, and a reduction of pressure below atmosphere on the leeward side. As an illustration of this theory, I send a photograph, Fig. 1, of an apparatus, by which it has been demonstrated that a ball or an ordinary 8-in. file can be supported in the air if a jet of air of sufficient velocity is passed over the rounded surface of the ball or the rounded end of the handle of the file. It would appear that the velocity of the jet passing over the rounded surface increases the pressure of the atmosphere

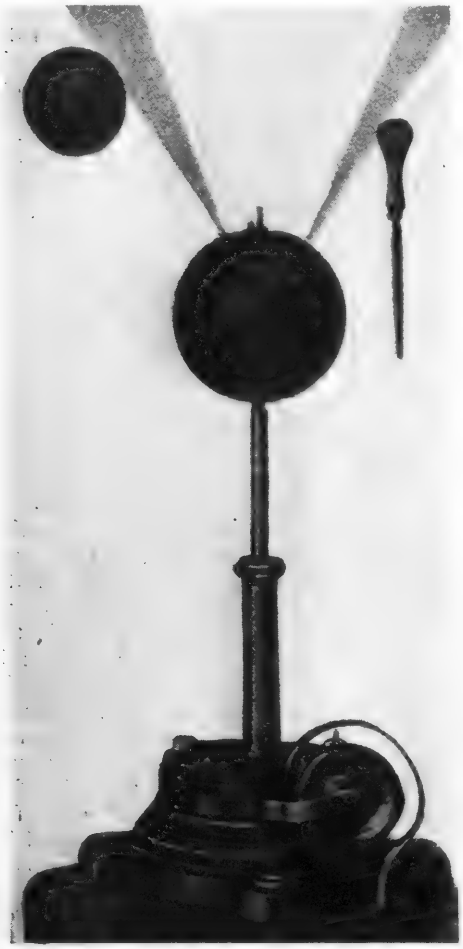


FIG. 1—ILLUSTRATION OF ACTION OF BRASHER AIR BREAKWATER.

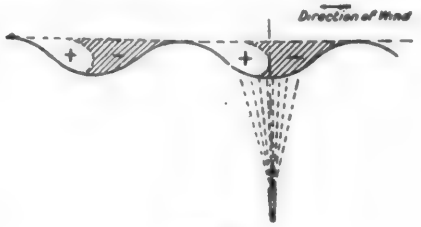


FIG. 2.

slightly on the rounded surface towards the jet and reduces the pressure on the opposite side below that of the atmosphere, so that the file or ball is held up to the jet by the pressure of the atmosphere. That the support afforded by these air pets is of some magnitude is proved by revolving the ball of the apparatus, which, being fed from the source of the air supply through the stem, forms a small reservoir for the jets or nozzles inserted in the ball. When the ball is revolved, which is done by the small air-driven wheel at the bottom of the stand, the articles supported in the air revolve with the jets, and a considerable pull on the end of the file is necessary to detach it from its support on the jet. To obtain the support of the jet the rounded surface of the ball or handle of the file must be approached gently to the lower surface of the jet, and must not enter the jet itself. The above explanation is given in order to illustrate my theory of the action of the wind on the surface of the water shown on the accompanying diagram, Fig. 2, which explains itself. This diagram suggests that waves have a difference of atmospheric pressure on their two sides caused by the velocity of the wind over their rounded crests.

"By Mr. Brasher's breakwater this difference of atmospheric pressure caused in the troughs between the waves by the velocity of the wind passing over their crests is neutralized by the admission of air above atmospheric pressure, which is delivered into that space by the jets of the breakwater from below the surface of the water and below the current of air passing over the crests of the waves. In this way the rise and advance of the waves is mechanically checked."

Efficient Heating for Institutional Groups.

By Albert L. Baum.

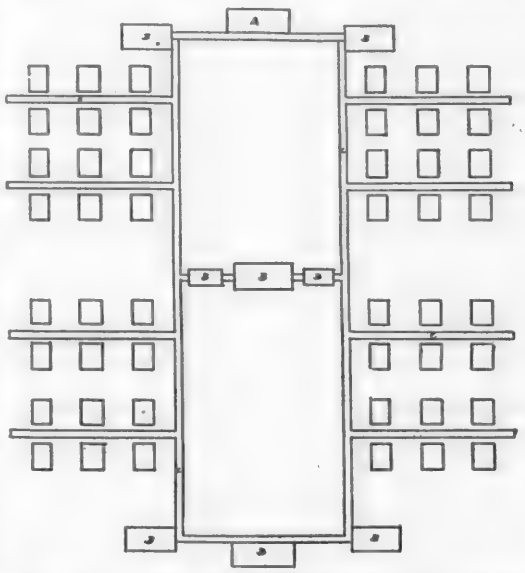
The present tendency in the design of our large institutions leans towards the village idea, i. e., a number of separate dwelling houses, interconnected by pleasant walks and passageways, and a few central buildings for service and administration purposes, the whole so arranged that it usually spreads over a considerable area. Generally speaking, sufficient funds are not at first available for the completion of the entire group of buildings as planned, but provision is usually made in such cases for future extensions and additions.

In serving such a group of buildings with heat, light, water, and power, the general aim is toward the centralization of service. The advantages of such a central plant are so well known, and have been presented so frequently, that I need not review them again. I shall take them for granted, and shall use the central plant as a starting point for this discussion of the type of heating system best adapted to such a group of buildings. It is obviously important that such a heating system be simple, reliable and effective. Good and healthful living conditions are vitally connected with proper heating. An error in the determination of so important a feature is most serious, and likely to result in tremendous expense if a rectification of that error is to be made at a later date.

The central plant having been determined on, the two possibilities as mediums for heating are steam and hot water. In order to more clearly understand the nature of the problem, let us consider a layout such as shown in the diagram, which represents a large institution of the hospital type, with isolated buildings. The distance from the power house to the end of the group is seen to be about 2,500 ft., almost one-half mile, and institutions have been designed, such as Letchworth Village for the Feeble-minded at Thiells, N. Y., where this distance exceeds a mile.

Whether steam or forced hot water is circulated as a means of heating the buildings, some exhaust steam will be available from the engines or turbines of the central generating plant; usually, however, not nearly enough for the full heating load. With a back-pressure on the generating units of not more than 3 or 4 lbs., it is evident that the exhaust steam, even if enough were available, cannot be used for heating the far buildings. These, if steam heated, will have to be served with high-pressure steam, reduced in pressure at the buildings, which will at least permit the use of smaller distributing mains.

Economy demands that the condensed steam be returned to the boilers in the central plant. The facility with which this may be done with steam heat depends largely on the relative levels of the buildings. A gravity return system is by far the cheapest. If this is not possible, a vacuum return line system may sometimes be utilized. But here, again, not only are proper grades essential, but the distance from the last buildings to the central plant must also be considered. A last resort for getting back the heating returns (where relative levels



BLOCK PLAN OF INSTITUTION OF HOSPITAL TYPE, WITH ISOLATED PAVILIONS.

A—Central boiler house and power house.
B—Administration and service buildings.
C—Interconnecting passageways for pavilions.
(Distance from boiler plant, A, to farthest building, B, 2,500 ft.)

forbid the use of either of the foregoing methods) is the system of pumping, and this means a number of return pumps scattered over the property, which must be provided with power, either steam or electric, and which also demand frequent attention both as to operation and maintenance. Such an arrangement materially decreases the advantages of the central heating plant.

ADVANTAGES OF HOT WATER.

Hot water as a heating medium, however, is not subject to such great restrictions. The water can be pumped regardless of grade, so long as proper provisions are made for relieving the entrained air from

*Member of Javos and Baum, consulting engineers, New York.

all high points where it may otherwise accumulate and cause air-binding of the mains. The water is heated in the central plant, easily utilizing (with a medium back-pressure) exhaust steam, which, as steam, could not be made to reach the farthest buildings. In plants of this kind the heating load is usually much larger than the power load. Under such conditions all the exhaust steam available during most of the heating season can be used directly for the hot water heating equipment; furthermore, the water of condensation is immediately regained without the slightest inconvenience. By no other distributing system can the heat be distributed with such little difficulty.

It is at once evident what a great advantage is effected by the central control of the hot water heating system. The operating engineer can at all times watch the temperature of the outgoing water, and vary it to suit varying weather conditions. During very severe weather the water may readily be heated as high as 200° F. (or even a little higher), thus giving out a large quantity of heat from the radiators and stacks in the buildings. As the weather becomes milder, the water temperature is reduced accordingly, thus cutting down the amount of heat supplied to each room in proportion to the decreased demands of the outside weather conditions.

With steam heat, overheating of the rooms is almost unavoidable, since the steam temperature in the radiators is nearly constant, regardless of weather conditions. The method usually followed in practice to avoid overheating in mild weather when a little heat is still required is to open the windows; this means, in effect, dumping out of the windows the equivalent of a large part of the coal consumed. One method of saving much of this waste is to use thermostatic control in all of the scattered buildings; but thermostats are delicate instruments, and are also expensive, both to install and to operate. Tampering with them does them no good, and, where it is desired to make simplicity the keynote of design and operation, delicate instruments, scattered all over the buildings, should be avoided. Another method of effecting coal economy is the use of a vacuum-return or open-return line system, with fractional steam control, and automatic return valves on the radiators. But the necessary appliances are expensive to install, involve care and maintenance, and require the frequent manipulation of hand valves all over the institution.

The hot water heating system, on the other hand, by its variation of water temperature avoids the need of thermostatic or other scattered means for controlling the temperature of the rooms. It therefore eliminates from the buildings all mechanical devices, with the exception of one or two automatic air traps in each building and a hand valve (which need rarely be touched) on each radiator. By means of this central control, and its ability at all times to avoid overheating the buildings, the forced hot water heating system secures the maximum of fuel economy with the minimum of mechanical elaboration and of attendance.

Besides avoiding the loss due to overheating of the rooms, as just explained, the hot water system has considerably smaller radiation losses from the distribuing mains than any of the steam systems. With the forced hot water system the maximum losses from this cause occur in the coldest weather, when the maximum water temperature is carried. As the weather becomes milder, the water temperature is lowered, and this in turn decreases the radiation losses from the mains. Steam, however, does not recognize changes in the weather. Whether the rooms are controlled by thermostats or by hand, or by open windows, the heating mains carry the steam continuously at a high temperature, since the temperature and pressure of steam are related by physical laws beyond the control of man. Hence the radiation losses, instead of becoming materially less in mild weather, as is the case with hot water, remain fairly constant throughout the heating season. The excess of these losses in the steam plant over those in the hot water plant for the same particular group of buildings may easily amount to several hundred tons of coal per year, depending on the size of the institution and the distance apart of the buildings.

The foregoing considerations have been presented from the point of view of operating costs. Coincident with operation are the costs of maintenance. The greatest part by far of the heating equipment of a large group of buildings on a widely extended area is the piping connecting all the heating surfaces with the source of heat in the central plant. In the steam heating system his entire network of piping carries during the heating season a mixture of steam, air and moisture, while during the summer it remains dry and empty. With the forced hot water heating system the piping can remain at all times filled with water, from which practically all dissolved air has been expelled. It has long been known that piping does not rust out nearly as rapidly while it remains filled with such

water as when in contact alternately with air and moisture. This gives the hot water system the advantage of much longer life, and longer life means a cheaper maintenance and depreciation charge, as well as less trouble from repairs.

There is still another phase of this question which, from a physician's point of view, should be important—namely, the health aspect of heating systems. Investigations have shown that particles of dust (largely organic matter) carried in the air begin to "burn" or decompose at about 165° F., and, since the temperature of the steam-heated radiator is always much higher than 165° F., it is at once evident what is taking place in a hospital ward heated by such radiators. The consistently lower temperature of the hot water radiators avoids in almost all cases this irritating annoyance from decomposing dust. It therefore secures a heating effect which is at once the more healthful of the two possibilities, and also affords a much more even temperature in the rooms due to the much lower intensity of radiation from the lower temperature radiators.

The only statement that can be made against a forced hot water system in favor of a steam heating plant for a group of buildings as herein shown is a possible slightly increased first cost of the hot water system. As opposed to this, however, are (1) the advantages of central control of the heat, (2) the simplicity of installation and operation, (3) the economy effected by avoiding overheating of buildings, (4) the economy effected by decreased radiation from the heating mains, (5) the longer life of the heating equipment, and (6) the more healthful character and more even distribution of the heat in the rooms, all of which go very far toward making forced hot water the ideal heating medium in a plant which proposes to be an effective and economic investment for the community as owner.—From the Modern Hospital.

Current Heating and Ventilating Literature.

(Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.)*

ELECTRIC HEATING—

Experience with Electric Heating of Dwellings. J. D. Ross. Ills. 2500 w. El W—Aug. 26, 1916. System tried at Seattle. 20c.

New Publications.

HOW TO BUILD UP FURNACE EFFICIENCY, by Joseph W. Hays (tenth edition), described as a handbook of fuel economy, is a book of 154 pages, and about as breezy a treatment of the subject as one could wish to find. Special pains have been taken to eliminate, as far as possible, a strictly technical discussion of the various points involved and the author "gets down to brass tacks" wherever possible. That Mr. Hays' popular treatment of the subject is appreciated may be judged from the statement that the book is now in its fiftieth thousand. One of the features of the new edition is the appearance of numerous charts, diagrams and other illustrations which supplement the text. Mr. Hays makes the flat statement that "any man who can read a scale and watch the flickering flame of a tallow candle is qualified to bring any boiler furnace up to the highest state of efficiency consistent with the fuel and the furnace equipment." Proceeding on this basis he takes up why, how and where fuel is wasted in the boiler room, many of his points being aptly turned by illustrative anecdotes. The narrative style is followed throughout. Size 5x7¼ in. Pp. 154 and index. Price $1.00 postpaid. Published by Jos. W. Hays, Rogers Park, Chicago, Ill., or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

BULLETIN OF THE NATIONAL DISTRICT HEATING ASSOCIATION for October, 1916, the quarterly publication of that association, contains as its leading article a description of the problems of underground piping in New York City, by Charles N. Green, one of the engineers for the New York Public Service Commission. The article takes up the tangled conditions of piping of all kinds in New York's streets, together with the complications that arose in connection with the building of the new subway extensions. He urged municipal regulation in the construction of all such work, suggesting that locations should be assigned for all subsurface structures in new streets and where possible in old streets. Another solution of the problem is the revoking of vault privileges and the use of sidewalks, as well as roadways, for the accommodation of public utilities. The association's "Question Box" contains some twenty questions and answers. One of the interesting questions was, "How much per 1,000 cu. ft. does it cost to wash air?" H. Carrier, of Chicago, answered this question by stating that the cost will vary widely on account of the varying cost of power in different localities and whether it is purchased or manufactured. Another variable item is the size of the unit,

the smaller the unit, the greater the proportionat cost. The following estimate is then given, based on a washer of about 25,000 cu. ft. per minute capacity, with power at 2 cents per horse power at the apparatus. It is assumed that the plant will be operated 3,000 hrs. a year. The annual cost per 1,000 cu. ft. per minute delivered for 3,000 hrs. will be about as follows:

Interest and depreciation per year..	$3.00
Care and repairs.....	2.00
Cost of extra horse power to drive ventilating fan 1 H. P. x 3,000 x $0.02	6.00
Cost of horse power to drive pump 0.15 H. P. x 3,000 x $0.02.....	9.00
Total cost per year per 1,000 cu. ft. of air per min. washed.....	$20.00

This will be a total cost of washing 180,000,000 cu. ft. in one year or a cost of $0.11 for each 1,000,000 cu. ft. washed. The horse power for moving the air and for operating the spray pump is taken from actual tests on the resistance of the washer, the efficiency of the fan, and the horse power input into the pump motor. Interest and depreciation is figured at 15% of the average plant cost.

JOURNAL OF THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for October, 1916, contains, among other things three papers to be presented at the forthcoming annual meeting of the society in January. These are "Remodeling the Ventilation of a Theatre," by S. R. Lewis; "Windows," by Dr. E. V. Hill; and "Railway Passenger Car Heating," by E. W. Rietz. The proceedings of the midsummer meeting in Detroit are published in this number, together with the discussions. Announcement is made that Volume 22 of the Transactions for 1916 (Volume 22) will soon go to press.

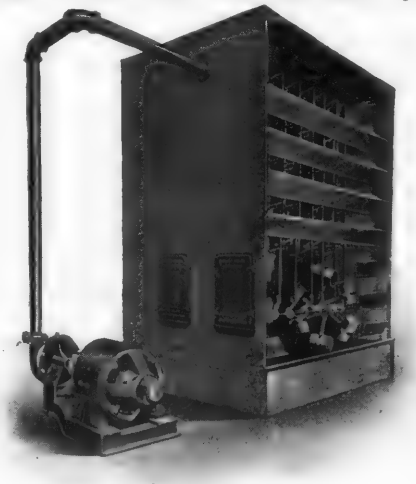
Trade Literature.

KEWANEE FIREBOX BOILERS, for steam and water heating, including brickset and portable types, are discussed in the company's catalogue No. 68, issued by the Kewanee Boiler Co., Kewanee, Ill. The catalogue is handsomely compiled, and includes numerous large sectional views, in half-tone, of both the brickset and portable types. Complete specifications and price lists for each type are also given. Size 6 x 9 in. (standard). Pp. 32.

MOLBY DOWN-DRAFT BOILERS are featured in catalogue matter sent out from the new address of the Molby Boiler Co., Inc., 101 Park avenue, New York. The company states that it has completed an entirely new equipment for the manufacture of these boilers, including patterns, flasks and shop equipment and is prepared to turn out boilers promptly, with every detail carefully worked out. Molby boilers are made in three series each, for steam and water. The steam series are 26 in. (six sizes ranging from 750 to 2,000 sq. ft. radiation); 31 in. (seven sizes ranging from 1,800 to 4.500 sq. ft.) and 47 in. (eight sizes ranging from 3,000 to 8,250 sq. ft). The water series are 26 in. (six sizes ranging from 1,250 to 3,350 sq. ft. of radiation), 31 in. (seven sizes ranging from 3,000 to 7,500 sq. ft), and 47 in. (eight sizes ranging from 5,000 to 13,750 sq. ft.).

THE MIDWINTER MORNING SCREAM (not a movie) is the title of what is described as a "thrilling farce melodrama in three screeches." passed by "the National Board of Goodsensorship" and published by the Bishop-Babcock-Becker Co., Cleveland, O. A study of the plot discloses the information that it has to do with the experiences of tenants in a cold office building, their remedy for their troubles and the comforts enjoyed when the remedy was applied. Needless to say, the remedy was the installation of a Bishop-Babcock-Becker "Reliable" vacuum steam heating system.

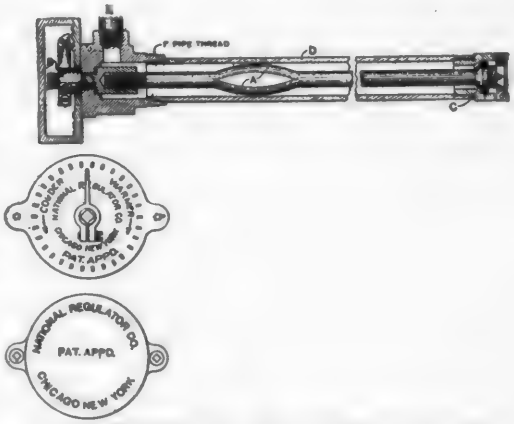
BICALKY AIR WASHERS are discussed in recently-issued circular matter received from the Bicalky Fan Co., Buffalo, N. Y., calling attention to the details of construction of this type. The automatic flushing feature is gone into at length. A rigid shaft is placed across the air washer above the sump. This runs freely and is rotated by means of buckets filled with falling waste water from the spray heads. Cams are arranged on this shaft under each vertical row of spray heads so as to operate a series of tee iron rods connected with the different rows of heads. When released by the cams these rods fall, and produce a hammer blow on the center rods of the spray heads, causing a rush of water through the nozzles, which dislodges any dirt



BICALKY AIR WASHER, SHOWING AUTOMATIC FLUSHING DEVICE.

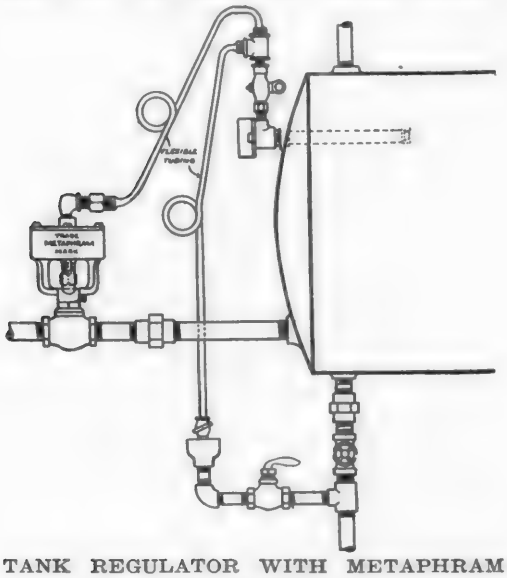
which may have accumulated in hindrance to a perfect mist spray. The cams are set so as to drop one tee at a time, which in turn flushes this verticle row of spray heads. This operation continues alternately. Emphasis is laid on the point that the mist from the spray heads remains intact while flushing. This, it is added, is of the greatest importance for the reason that it offers no weak spot in the mist sheets during the flushing operations to permit any of the foreign matter passing through the air washer. The circular also shows and describes the spray heads and eliminator plates used with the Bicalky air washer, as well as the strainer, door and spray chamber.

National Tank Regulators and their operation when equipped with Metaphram valves are featured in newly-issued circular matter received from the National Regulator Co., Chicago. As regards the regulator itself, the stem, D, is provided with a 1-in. pipe thread, inserted into the tank and subjected to the water under pressure. When the temperature of the water rises, element A, being highly sensitive, expands, and the valve C attached to the end of the element is thrust from its seat, allowing the water under pressure to rush through the stem of the regulator and thence to the diaphragm motor or valve, whichever the case may be, closing off the heat source. When the temperature of the water falls, the element A contracts quickly and pulls the valve C to its seat, preventing further flow. Consequently the motor or valve will expel its pressure through the waste and thus open the heat source. The Metaphram hydraulic tank regulators are graduated in action, which, it is stated, is a trait peculiar to National thermostats, making them sensitive to quick temperature changes, affording close regulation, and increasing fuel economy. These regulators are self-contained so that they are dust-proof and are all metal. They are furnished complete with a 12-ft. length flexible tubing.

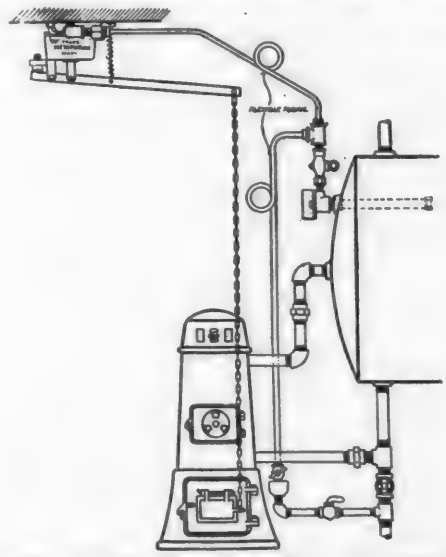


CONSTRUCTION OF NATIONAL TANK REGULATOR.

Reliable Evidence is the title of an impressive installation book published by the Bishop-Babcock-Becker Co., Cleveland, O., listing 879 prominent buildings, of which 146 are illustrated, all equipped with Reliable vacu-vapor vacuum and vacu-vapor heating systems. The various installations are grouped and classified according to types of buildings and geographical location. Endorsements from owners are presented in the form of foot-notes, the whole comprising, as the company states, "reliable evidence" as to the quality and versatility of Reliable equipment. These points



TANK REGULATOR WITH METAPHRAM VALVE FOR THE CONTROL OF A STEAM-HEATED TANK.

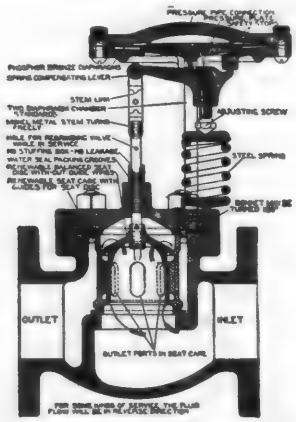


TANK REGULATOR WITH METAPHRAM MOTOR FOR THE CONTROL OF A COAL HEATER.

are emphasized by the fact that the installations include remodeled, as well as new, plants while the sizes and styles of buildings range from the skyscraper to the bungalow. The closing pages are devoted to the devices composing the Reliable systems, including the VacUstat, the vacu-trap, the vacu-graduate packless radiator valve, and the Reliable vacuum pump. Size 8x10¾ in. (bound in boards). Pp. 48.

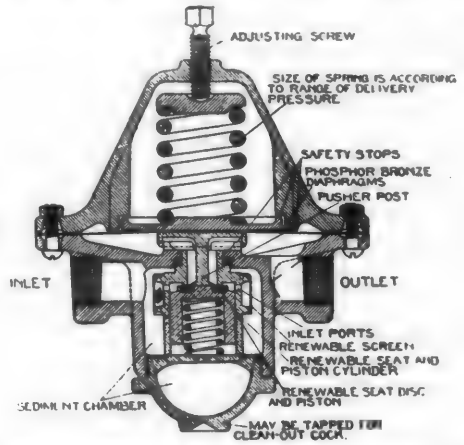
MODIFIED SQUIRREL CAGE FANS, Massachusetts multiblade type, is the title of Bulletin No. 1 of a new series of engineering bulletins being published by the Consolidated Engineering Co., Chicago, Ill. The bulletin is intelligently prepared for the use of the engineer. All superfluous matter is eliminated and the text confined strictly to engineering data. One page is devoted to standard arrangements and discharges of the Modified Squirrel Cage Fan for ten different arrangements. On the opposite page is presented a table of weights of fans for these arrangements. The remaining pages of the catalogue are given over to data tables for single-width, single-inlet Modified Squirrel Cage fans, covering full-housed bottom horizontal discharge, full housed top horizontal discharge, full housed top vertical discharge and ⅞-housed bottom horizontal discharge. Size 8½x11 in. (standard). Pp. 32.

CASH STANDARD REDUCING AND REGULATING VALVES, Class C, Class E and Class D, are the subject of well prepared circular matter received from the A. W. Cash Co., Decatur, Ill. The Class C valve is of the outside diaphragm and compensating lever type, with balanced double seat, and is for service on high and low



CONSTRUCTION OF CASH CLASS C REGULATOR.

pressure steam for power and heating purposes, pump and air compressor governors, etc. Class E valve is for service where the initial pressure is not greater than 40 lbs. and the delivery pressure not greater than 5 lbs. It is especially useful for low pressure district steam heating. The Class D valve is of the diaphragm type and has single, renewable valve seat and seat discs. It is designed for service on cold water, hot water, steam, air,



CONSTRUCTION OF CASH CLASS D REGULATOR.

oil and gas lines, being made for water or air with an initial pressure as high as 200 lbs. and for steam with an initial pressure as high as 150 lbs. and delivery pressure not higher than 100 lbs. Valves of this type are also made for heavier service.

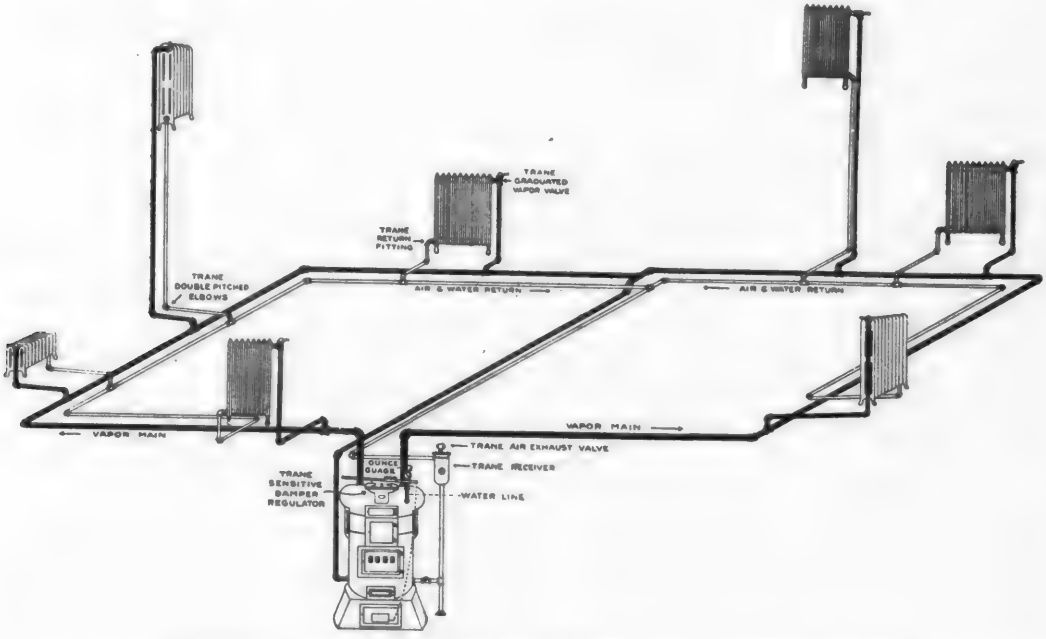
CARRIER AIR CONDITIONING AND DRYING EQUIPMENT is treated in a series of unusual engineering bulletins published by the Carrier Engineering Corporation, New York. The latest bulletin (No. 103) discusses the Carrier system of humidifying as applied to textile mills. The bulletin is profusely illustrated with views and plans of typical installations, accompanied by carefully-prepared text on the advantages of the Carrier humidifying system for textile mills, advantages of artificial humidification, conditions affecting humidity, action within the humidifier in summer, and numerous other points. A notable feature of the bulletin is a series of extracts from engineers' reports giving convincing data as to the effectiveness of the installations. Size 6x9 in. (standard). Pp. 54. Bulletin No. 100, previously published, deals generally with Carrier humidifying apparatus, while Bulletin No. 101 covers Carrier dehumidifying apparatus.

VULCAN'S FORGE, the house organ of the Vulcan Fuel Economy Co., Chicago, announces the change of this firm's name from G. L. Simonds & Co. The company's line includes the Vulcan soot cleaner, Hays gas analysis instruments, Hays differential draft gage, Dean boiler tube cleaner and the Eclipse smoke indicator. The firm was incorporated in 1909 and the new name is adopted to more

fully describe ts activtes. The personnel and policies of the organization remain as before. The same issue contains an interesting article on "How Long Will Our Supply of Coal Last?"

VALVE WORLD for October, 1916, the monthly periodical of Crane Co., Chicago, discusses "Cast Steel" in its series of non-technical chats, by L. W. Spring, the company's chief metallurgist, which are running in this journal. The article includes illustrations of the first experimental arc electric furnace and of the Snyder electric furnace.

TRANE VAPOR HEATING, described as a simple, noiseless and economical system of vapor heating proven by years of successful operation, is the subject of a new catalogue issued by the Trane Co., La Crosse, Wis. The Trane specialties consist of a vapor regulator, receiver and air-exhaust valve, and ounce pressure gauge for the boiler; also graduated vapor valves, together with special return fittings or thermo traps, for the radiators. In the operation of the system there are preferably two balanced circuts running each way from the boiler, as shown in the illustration by the solid piping which is the vapor main. The air and water return is practically the same length as the supply main. When properly worked out this has the same effect as though each radiator were placed an equal distance from the boiler. Particular care, it is stated, has been given to developing an extremely sensitive and quick-acting vapor regulator. In the Trane system the vapor regulator is connected into the steam dome or into the supply pipe on top of the boiler and chains run from the end of the lever arm to the draft door and to the check draft in the smoke pipe. The pressure in the boiler operates on the body of water in the bottom of the regulator. The Trane special return fitting is of unique design, having two separate openings for the escape of air and water from the return of the radiator. This fitting, it is stated, effectively prevents the escape of steam. The closing pages of the catalogue are devoted to illustrations of typical buildings equipped with Trane systems, accompanied, in many cases, with letters from satsfied users. Size 6x9 in. (standard). Pp. 32.



TYPICAL LAYOUT OF TRANE SYSTEM OF VAPOR HEATING.

Pittsburgh's "Smoke Abatement Week."

The last seven days of October were observed in Pittsburgh as "Smoke Abatement Week," the idea being to impress the public generally with the progress that has been made in abating the smoke nuisance in that city. This movement has been in progress in Pittsburgh for four years or more. It involved the establishment of a Bureau of Smoke Regulation, connected with the Department of Health, assisted by many prominent engineers serving as an advisory board. Up to date last year more than 7,500 inspections had been made, which

resulted not only in a very noticeable smoke reduction, but in many cases served to bring about an economy in operation.

It is claimed that the outpouring of smoke has been reduced at least 75%, the abatement being particularly noticeable to the traveler familiar with Pittsburgh in former days when it was known as the "Smoky City."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF THE HEATING AND VENTILATING MAGAZINE, published monthly at New York, N. Y., for October 1, 1916.

State of New York } ss.
County of New York }

Before me, a notary in and for the State aforesaid, personally appeared A. S. Armagnac, who, having been duly sworn according to law, deposes and says that he is the Editor of The Heating and Ventilating Magazine, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in Section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Heating and Ventilating Magazine Co., 1123 Broadway, New York.

Editor, A. S. Armagnac, 1123 Broadway, New York.

Managing Editor, None.

Business Manager, Gustave Petersen, 1123 Broadway, New York.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.)

Heating and Ventilating Magazine Co., 1123 Broadway, New York.

A. S. Armagnac, 1123 Broadway, New York.

Gustave Petersen, 1123 Broadway, New York.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are:

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. A. S. ARMAGNAC, Editor.

Sworn to and subscribed before me this 12th day of September, 1916. HAROLD MARCOE,

Notary Public Queens County No. 1373. New York County Clerk's No. 29. New York County Register's No. 7030.

(My commission expires March 30, 1917.)

ADVERTISERS' INDEX

Air Moistener Co., The..... 68
American District Steam Co..... 79
American Blower Co..... 69
American Radiator Co.....Back Cover
Armstrong Mfg. Co..... 59
Badger & Sons Co., E. B..... 81
Bayley Mfg. Co..... 71
Bicalky Fan Co..... 12
Bishop-Babcock-Becker Co..... 60
Bristol Co., The.....Front Cover
Buffalo Forge Co..... 8
Carrier Engineering Corporation, Second Cover
Connersville Blower Co..... 3
Dahlquist Mfg. Co..... 59
Davis Regulator Co., G. M..... 82
Detroit Lubricator Co..... 63
Dicks, Slosson Co..... 66
Dole Valve Co.....Front Cover
Dunham Co., C. A..... 12
Economy Pumping Machinery Co..... 74
Foster Engineering Co..... 6
Foxboro Co., The..... 61
Fulton Co., The..... 4
Gurney Heater Mfg. Co.....Front Cover
Hornung, J. C..... 79
Houghton & Co., E. F..... 5
Ilg Electric Ventilating Co..... 64
Jenkins Bros. 61
Johns-Manville Co., H. W..... 73
Johnson Service Co..... 71
Knowles Mushroom Ventilator Co., Front Cover
Marsh Co., Jas. P..... 3
Mason Regulator Co.....Front Cover
Molby Boiler Co., Inc.....Third Cover
Mueller Mfg. Co., H..... 7
Nash Engineering Co..... 10
National Regulator Co..... 6
National Tube Co..... 9
Parker Supply Co..... —
Powers Regulator Co..... 10
Patterson & Co., Frank..... 76
Ric-Wil Co. 80
Ross Valve Mfg. Co.....Front Cover
Sarco Company, Inc..... 8
Savo Mfg. Co..... 72
Sims Co., The..... 82
Spencer Turbine Cleaner Co..... 74
Sprague Electric Works..... 75
Standard Thermometer Co..... 72
Standard Wood Pipe Co..... 80
Sturtevant Co., B. F.....65, 67, 68 and 75
Syracuse Faucet & Valve Co..... 7
Taylor Instrument Companies..... 62
United Vacuum Appliance Co..... 75
Webster & Co., Warren..... 70
Westinghouse Electric & Mfg. Co.... 78

TRADE AND MISCELLANEOUS NOTES

Coming Events.

December 5-8, 1916.—Annual meeting of The American Society of Mechanical Engineers, in New York. Headquarters at the Engineering Societies Building, 29 West 39th street.

January 16-18, 1917.—Annual meeting of The American Society of Heating and Ventilating Engineers. Headquarters in the Engineering Societies Building, 29 West 39th street. Secretary, C. W. Obert.

Deaths.

John Reid, Sr., treasurer of the J. L. Mott Iron Works, New York, died at his home in Yonkers, N. Y. He had been in poor health for some time. Mr. Reid was 76 years old and had been connected with the J. L. Mott Company ever since coming to this country from Scotland in 1865. He had been treasurer and general manager for forty years. Mr. Reid was looked upon as the father of American golf and was the first president of the United States Golf Association. He leaves a widow, two sons and two daughters.

Miscellaneous Notes.

Philadelphia, Pa.—The most modern and scientifically perfect system of ventilation and illumination will be used in Philadelphia's subways if the provision contained in the transit ordinance introduced by Mayor Smith in council and approved by that body is incorporated in the lease between the city and the operating company. The motion of the trains in the Philadelphia subways is usually sufficient to provide the necessary ventilation, provided there are enough air ducts leading to the outside air. In the city's new subways, however, this natural system of ventilation is to be supplemented by motor-driven exhaust fans and motor-driven blowers. Referring particularly to the ventilating fans, one section of the ordinance reads:

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

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PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

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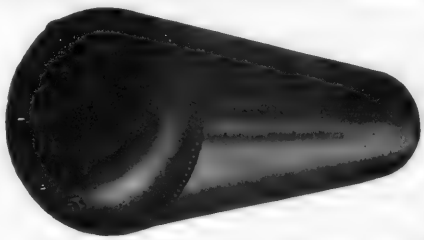

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For Large Apartment Houses, Hotels, Hospitals, Restaurants, and Public Institutions.

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Engineers recognize the high character of our product by specifying "The Dahlquist Boilers" on their most exacting work. **Write for catalogues**

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To augment this air supply, if necessary, and to provide at any time for the removal of smoke in case of fire, also to insure a supply at times of minimum operation of trains or entire stoppage thereof, motor-driven blowers of an approved pattern shall be provided. These blowers shall be of such capacity as may be necessary to renew the tunnel air once in every fifteen minutes independently of the action of the trains.

The blowers shall each be provided with motors of adequate power to operate them at all times to their full capacity, and these motors shall be so arranged that groups of blowers can be started simultaneously from some convenient point of control.

In all inclosed rooms in the underground structure motor-driven exhaust fans are to be provided in addition to the blowers, which when operating together shall be of such capacity as to renew the air completely in the various rooms every five minutes.

Building Operations for September, 1916, as compiled by the American Contractor, Chicago, Ill., total $72,735,764 as compared with $68,861,798 for September, 1915. This is a gain of 6%. Cities showing important gains are: Akron, 396%; Dayton, 215%; Detroit, 81%; East Orange, N. J., 352%; Hoboken, N. J., 5086% ($470,888 as compared with $9,080); Lawrence, Mass., 204%; Minneapolis, 92%; Nashville, 381%; New York City (Borough of Manhattan), 147% ($3,-3336,551 as compared with $1,348,267); Omaha, 99%; Portland, Ore., 340%; Reading, Pa., 159%; Sacramento, Cal., 240%; San Diego, Cal., 94%; Schenectady, N. Y., 76%; South Bend, Ind., 410%; Springfield, Ill., 111%; St. Louis, 124%, and Tacoma, 251%. Cities reporting appreciable losses were: Cincinnati, 33%; Louisville, 56%; Milwaukee, 70%; New Haven, Conn., 78%; Philadelphia, 30%; Pittsburgh, 38%; Salt Lake City, 49%; St. Paul, Minn., 55%, and Utica, 30%. Boston, with $5,133,000; Chicago, with $8,579,550, and New York, with $8,372,868 approximated last year's figures for the corresponding month.

New York School of Heating and Ventilating Alumni Association held its first meeting of the season October 17 at Stewart's Café, 30 Park place, New York. It was announced by Charles A. Fuller, who is conducting the school, that over 70 students have enrolled in the regular class and 28 in the new advanced class. The alumni association will continue to meet during the winter.

Davenport, Ia.—A case somewhat novel in police circles was begun in Davenport

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of this big catalog, which contains lots of valuable information, data, charts and suggestions for specifications on Air Line and Return Line Vacuum and Vapor Heating Systems, and illustrates and describes thoroughly the big line of RELIABLE Vacuum and Vacu-Vapor Heating Equipment—RELIABLE Vacuum Pumps, VacUstats, Vacu-Traps, Vacu-Checks, Vacu-Graduate Packless Radiator Valves, "4 V" Vent Valves, etc. This will not obligate you. We want you to see this catalog. You will be interested in it!

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recently when Building Inspector Ralph C. Graham filed information charging Harry High with refusing to obey the city ordinance calling for a ventilator in a toilet room of his residence. According to the allegations, Mr. High refused to obey the mandate of the building inspector in spite of the fact that the only ventilation in the room, the inspector states, is through one window which opens into the kitchen.

Hawaiian factories, in a number of cases, are installing apparatus to burn exhausted molasses which, until recently, has been allowed to go to waste. The heat generated is used for furnishing steam for the factory. The ash from the molasses, which contains 33.32% of potash and 4.6% of phosphoric acid, is used as fertilizer.

Canvas pipe for ventilation is being used in places where blasting is being done. The piping, which is varnished, has the advantage of being practically proof against damage from blasts, as it collapses if struck.

Nashville, Tenn.—A proposed ordinance has been introduced before the city commission, and has passed its first reading, regulating the method of ventilation and storing in dry cleaning establishments.

New Zealand's factories will soon have to be adequately heated if efforts now being made to amend the factory laws in that country are successful. The proposed law would compel owners of factories in certain of the colder sections of the dominion to heat their plants during the winter months, and Consul-General Alfred A. Winston calls the attention of American manufacturers of heating apparatus to what he described as a possible demand for their product in New Zealand.

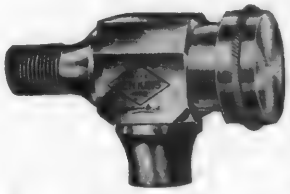
Abingdon, Ill.—Probably the only school in the State having its own supply of gas for heating and lighting is located in District No. 17, near Dorchester, in Macoupin County. Located in the center of a rich gas field, the school has a well of its own located on the school grounds which is said to compare favorably with other wells in that vicinity.

Muscatine, Ia.—The street car heating ordinance in Muscatine provides that the vestibules as well as the interiors of street cars shall be heated. The council has previously been lenient in its enforcement of this part of the ordinance, but it is announced that the law will be enforced the coming winter. The contention was made by the street car company at the time the ordinance was passed that with the present equipment it was impossible to heat the vestibules and maintain the required temperature inside the cars during extremely cold weather. This being the case, it is expected that the next few weeks will see the installation of new heating equipment in the cars.

Boiler and radiator prices were advanced 5% on October 2. This follows a previous advance announced on September 25. It is stated that there is no certainty that further advances in the selling prices will not be necessary.

Jenkins Automatic Air Valves

For Steam Radiators and Heating Coils



Operate by means of the thermostatic expansion and contraction of the Jenkins composition plug. Simple in construction, automatic in action, efficient in service. Thousands in use. Inexpensive, and easily repaired if necessary, which can be done without removing the valve from radiator by simply replacing plug and screw.

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TO INDICATE or RECORD TEMPERATURES and PRESSURE

They have a distinctive quality with a fineness of mechanical detail which insures Accuracy and Durability under the hardest Service

THE FOXBORO COMPANY, FOXBORO, MASS.

New York Chicago St. Louis Birmingham, Ala. San Francisco

Ohio Society of Mechanical, Electrical and Steam Engineers will hold its annual meeting in Columbus, November 16.

Chicago, Ill.—A class in heating and ventilation has recently been organized at the Crane Technical High School, Oakley avenue and Van Buren street. The class meets Tuesdays and Thursdays. It is designed especially for journeymen and apprentices.

Chicago, Ill.—In response to a suggestion made by Dr. E. V. Hill, chief inspector of the ventilation division of the Chicago Department of Health, and vice-president of the heating engineers' Illinois Chapter, that it would be desirable to have new tests made covering the relations of temperature, humidity and air motion in rooms, an offer has been made by A. S. Schroth, vice-president of the Cameron-Schroth Company, of Chicago, to construct such a room in the company's factory where the tests will be carried out. The plan is to install an equipment which will allow the temperature to be varied between 20° and 100° F., the relative humidity between 10% and 100%, and the air motion from zero to 1,500 ft. per minute.

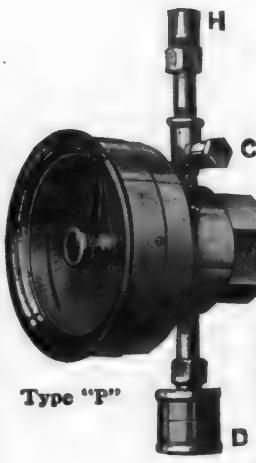
Chicago Commission on Ventilation elected the following officers at its meeting in the Morrison Hotel, September 18: President, Fred J. Postel vice-president, John Howatt; secretary-treasurer, J. W. Sheperd. The following committees were also appointed: Publication: Robertson, Lewis and Sheperd; Finance, Robertson, Sturm and Beaumont; Air Distribution: Sheperd, Harkins, Hill and Howatt; Tests on Portable Schools, Gravity Direct and Indirect: Hart, Howatt, Davis and Lewis; Test on Chicago and Cook County School for Boys: Beaumont, Hill, Howatt and Hart; Test on Direct Radiators and Mechanical Ventilation: Sturm, Lewis, Sheperd and Robertson; Test on Everett School: Hill, Sturm. Harkins and Davis; Test on Champlain School: Hart, Howatt, Davis and Beaumont; Ventilation of Special Rooms, Chemical Laboratories: Harkins, Lewis, Sheperd and Howatt.

Salt Lake City, Utah.—The Federal jury in the case against twelve master plumbers of Utah and Colorado, who, as members of the National Association of Master Plumbers, were charged with violating the Sherman anti-trust law, returned a verdict of guilty September 30, with a recommen-

H&M Thermometers

Regulators

Automatic Temperature and Pressure



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Tycos mercury operated, steel construction Recording Thermometers, Angle and Straight Stem Thermometers, All Glass Engraved Stem Thermometers, Hygrodeiks and Hygrometers, Thermo-Electro and Radiation Pyrometers.

The *Tycos* Mercury Operated Recording Thermometer

Mark this: — Every Instrument bearing H & M *Tycos* makes honest claim to supremacy because every manufacturing step is carefully worked out in detail, applications carefully studied.

Put your problem up to us. Our experience will prove very valuable to you. Our service prompt and efficient, suggestions and literature free. Command us.

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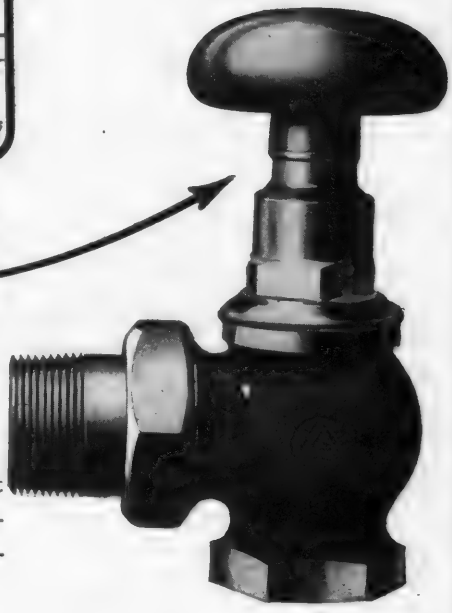
DETROIT PACKLESS RADIATOR VALVES

The Packless Valve
ELIMINATES
DISSATISFACTION



Detroit Packless Valves give perfect satisfaction to both tenants and owners. A valve that always stays tight—can't leak.

Specify Genuine Detroit Packless Valves

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DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO, CANADA

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

dation for mercy. The defendants were charged with conspiracy to prevent plumbers not members of the National Association from getting supplies. The following fines were imposed, which were paid the same day: Chris. Irving, Denver, $1,500; Charles J. Higson, Salt Lake City, $750; William S. Higham, Foster W. Jones, Henry Green, William Rossiter, P. G. James and Frank Carthey, all of Salt Lake City, $500 each; James Macbeth, of Ogden, was also fined $500, while John A. Forsyth, of Price, and A. J. Atkin, of Ogden, were fined $250 each.

E. D. Hornbrook, Kansas City, Mo., a former president of the National Association of Master Plumbers, was injured in an automobile collision, near Joplin, Mo., October 5. Mr. Hornbrook was taken to St. John's Hospital in Joplin, where it was found that his shoulders were broken. The accident, however, was not considered serious.

A. W. Magill, of the Chicago office of the Kewanee Boiler Company, has been under the doctor's care for the past two months, due to an attack of heart trouble.

Judson A. Goodrich has resigned as gen-

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DIRECT CONNECTED BLOWERS

Compact—Efficient—Quiet Running

EASY TO INSTALL

One Nameplate, One Guarantee Covering Fan and Motor

ILG Electric Ventilating Co. 158 Whiting Street CHICAGO, ILL.

Erie Theatre, Chicago, has

Sturtevant AirWashers
(REG. U.S. PAT. OFF.)

Sturtevant Type H Air Washers are being installed in prominent buildings all over the country, and this is due to mechanical advantages as follows:

Sturtevant Heating and Ventilating Apparatus as installed in the Erie Theatre, Chicago.
Engineers and Contractors, Phillips, Getschow Co., Chicago.

Strainer area more than twice that of any other washer made and ten times the area of some.

Strainer designed for removal for cleaning. No bolts, clamps or latches to be manipulated or to give trouble.

More nozzles per thousand cubic feet of air than any other washer.

Trap in overflow.

Supplies more water to eliminator plates for auxiliary washing than any other apparatus.

Furnished with louver diffuser plates on inlet side.

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And All Principal Cities of the World

eral manager and treasurer of the Atlantic Radiator Company and is devoting his time to his personal interests.

Eastern Supply Association elected Guilford R. Adams as its president at its annual meeting in New York, October 18. Mr. Adams succeeds L. O. Koven, who retires after several terms of successful administration. Mr. Koven in his address said, in part: "My work as your president is finished. Gentlemen, you have a greater association than you know. There is nothing pertaining to correct business methods which cannot be taken up by this association and accomplished, provided all of you are sincere." The report of the credit bureau showed that the total number of claims received to date is 6,608. The total amount of claims reported to date is $692,998, and the total amount collected $444,159. The following recommendation was carried unanimously:

"Realizing the great value and importance of the interchange of credit information between credit grantors in the plumbing and heating lines, your credit committee hereby endorses this method, and recommends that a department be installed in the Eastern Supply Association to facilitate such interchange between its members, details to be worked out by the credit committee, and the plan made effective by December 1, 1916.

Another resolution was passed to the effect that the manufacturers of soil pipe and fittings be requested to make their standard of medium fittings the same dimensions, as regards length and internal diameter, as the extra heavy fittings which were standardized in 1912. The full list of officers elected is as follows:

President, G. R. Adams, Samuel Sloan & Co., Rochester, N. Y.; first vice-president, Joseph F. Evans, Wyoming Valley Supply Co., Wilkes-Barre, Pa.; second vice-president, A. M. Maddock, Thos. Maddock's Sons Co., Trenton, N. J.; treasurer, Martin Behrer, Behrer & Co., New York, N. Y.; secretary, Frank S. Hanley, 261 Broadway, New York, N. Y.

Board of Directors —G. R. Adams, Joseph F. Evans, A. M. Maddock, Martin Behrer, W. L. Blake, Portland, Me.; Jas. F. Conran, Standard Sanitary Mfg. Co., Pittsburgh, Pa.; Jas. P. McPhail, Jas. Robertson Mfg. Co., Baltimore, Md.; J. A. Murray, New York, N. Y.; F. T. Stevens, Plimpton Hills Corp., Hartford, Conn.; O. G. Hitchcock, Hays Mfg. Co., Erie, Pa.; A. A. Tomlinson, Virginia-Carolina Supply Co., Norfolk, Va.

Advisory—L. O. Koven, New York.

National Committee—F. W. Hubbard, Boston; D. L. Hamill, Buffalo, N. Y.; E. S. Aitken, Trenton Potteries Co., Trenton,

Few Men know that health and humidity go hand in hand.

It is a proven fact that dry, fresh air is only half the battle in improving air conditions.

You dry out the fresh air when you bring it into a warm room.

NORMALAIR HUMIDIFIERS

will save from 12½ to 25 per cent in your heating bills.

NORMALAIR HUMIDIFIERS

are automatically maintaining the correct percentage of moisture in the atmosphere of offices and theatres, and in manufacturing plants where moisture is also absolutely essential for handling various materials.

Easy to install—automatically operated. Detailed information furnished on request.

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DICKS, SLOSSON CO., Inc. 302 BROADWAY NEW YORK

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New Catalog on Sturtevant Heaters

(REG. U. S. PAT. OFF.)

Our new catalog on heaters contains complete information and data for the benefit of Heating and Ventilating Engineers.
The book includes temperature rises, piping diagrams, dimensions, weights, areas, and all other necessary information.
Copy of this new publication, Number 230-V, will be sent on request. We prefer that you write on your letter-head.

B. F. STURTEVANT COMPANY

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And All Principal Cities of the World

N. J.; W. A. Speakman, Wilmington, Del.; John Fleck, Fleck Bros., Phiadelphia, Pa.

National Councilor, Chamber of Commerce—L. O. Koven, New York.

Central Supply Association elected the following officers at its annual meeting, held in Chicago, October 25: President, John F. Wolff, L. Wolff Mfg. Co., Chicago; first vice-president, M. J. O'Fallon, M. J. O'Fallon Supply Co., Denver, Colo.; second vice-president, A. Y. McDonald, A. Y. McDonald Mfg. Co., Dubuque, Ia.; treasurer, Edward F. Niedecken, Hoffmann & Billings Mfg. Co., Milwaukee, Wis.; secretary, Paul Blatchford, 1915 City Hall Square Bldg., Chicago.

Executive Committee: John E. Wolff, Chicago; M. J. O'Fallon, Denver, Colo.; A. Y. McDonald, Dubuque, Ia.; C. V. Kellogg, Chicago; P. J. Frey, Minneapolis, Minn.; A. A. Merkel, Cincinnati, O.; Edward F. Niedecken, Milwaukee, Wis.; J. D. Tschopik, Pittsburgh, Pa.; E. I. Leighton, Fort Dodge, Ia.

National Committee: J. J. Ryan, Chicago; W. A. Myler, Pittsburgh, Pa.; John F. Wolff, Chicago; F. D. Keeler, Rockford; J. P. Hartnett, St. Louis, Mo.

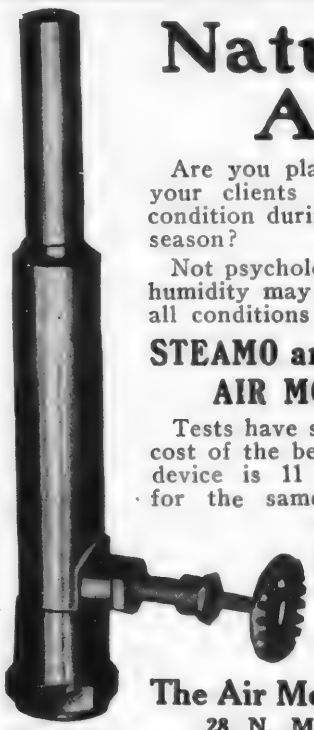
Delegate to the Chamber of Commerce of the U. S. A.: Theodore Ahrens, Standard Sanitary Mfg. Co., Pittsburgh, Pa.; alternate delegate, George H. Bailey, Bailey-Farrell Mfg. Co., Pittsburgh, Pa.

The following concerns were elected to membership: Goulds Mfg. Co., Jones & Laughlin Steel Co., Kewanee Boiler Co., Chicago Tube & Iron Co. and the United Pump & Power Co.

Over 350 members and guests sat down to the association's banquet, which was held in the Gold Room of the Congress Hotel on the same evening.

Stephen Roberts, for many years in charge of the publicity department of the Peerless Rubber Mfg. Co., New York, manufacturers of rubber packing and other steam supplies, is now associated with Everyday Mechanics Magazine as advertising manager. Everyday Mechanics is a comparatively new publication of pocket size, devoted to the interests of amateurs, young and old, "who wish to make and do things." The offices of the magazine are in the Aeolian Building, New York.

An invitation has been extended by the Merchants' Association of New York to the American Health Association to hold its next annual meeting in New York. The American Public Health Association met this year in Cincinnati.



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Natural Air

Are you planning to give your clients a natural air condition during the heating season?

Not psychological but real humidity may be had under all conditions by using

STEAMO and VAPO AIR MOISTENERS

Tests have shown that the cost of the best evaporating device is 11 times greater for the same quantity of moisture than that of the Steamo Air Moistener.

Send for new catalogue.

The Air Moistener Co.
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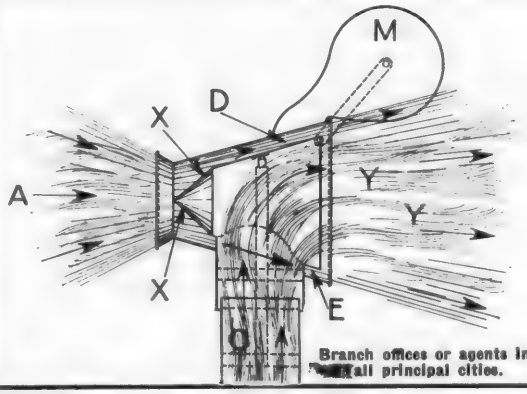

Branch offices or agents in all principal cities.

It works on the same successful principle as a Steam Injector.

Sturtevant Autoforce Ventilator

utilizes the wind pressure to create a powerful suction that draws air out of the building. That is why it displaces three times as much air as any stationary ventilator of the same size, and twice as much as any swinging cowl ventilator.

Specify Autoforce Ventilators.

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HYDE PARK, BOSTON, MASS.

Largest Manufacturers in the World of Heating and Ventilating Apparatus, Fans and Fan Systems

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Barbara Worth Hotel, El Centro, California

Where "Sirocco" Keeps Temperature at 70 Degrees with Outside Temperature of 100 Degrees

Every room in the Barbara Worth Hotel is heated and ventilated by the American Blower System. The plant has proven eminently satisfactory in every respect and on two different occasions tests of this installation have been made. The tests showed that with the temperature outside at 100 degrees F., a temperature of 70 degrees was maintained throughout the building. This is accomplished purely by the evaporation of water and without the use of any refrigerating coils or ice.

Any way you figure it, the above is a remarkable accomplishment. In fact it seems almost impossible until you consider that a temperature in El Centro of 100 degrees F. dry bulb corresponds to a wet bulb temperature of 62½ degrees.

"The Commercial Value of Washed Air," Publication No. 9A, gives interesting details regarding the "Sirocco System."

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN

BRANCHES EVERYWHERE

Central Station Heating Notes.

Kansas City Heating Co., a subsidiary of the Kansas City Light & Power Co., Kansas City, Mo., is planning to spend about $300,000 in the extension of its plant and equipment.

Iowa Falls, Ia.—As the result of a deal whereby the Iowa Falls Electric Company took over the electric equipment of the Commonwealth Light and Power Company, of Iowa Falls, the heat patrons of the Commonwealth company have been left without a supply of central station heat. This is due to the fact that the Iowa Falls Electric Company did not take over any of the heating apparatus or heat mains of the Commonwealth company. The Iowa Falls company has also announced that it will not take on any more heat patrons until next summer. This action was taken to avoid shutting off heat and discommoding regular patrons while such changes were made. In the meantime the Commonwealth company has shut down its heating system, although live steam was furnished for a short time to heat Hotel Woods until the private plant in that building was completed. The Iowa Falls Electric Company has at present 77,000 sq. ft. of radiation connected in Iowa Falls.

Bellefonte, Pa.—The Bellefonte Gas & Steam Co., Bellefonte, Pa., was sold September 18 at a sheriff's sale to Former Judge Orvis, representing himself and Col. Hugh S. Taylor. The amount realized was $16,100, subject to a first mortgage of $12,000 and $5,000 interest. The sale was made after the liveliest kind of bidding between N. B. Spangler, representing the State Central Electric Company, and Judge Orvis. For weeks previous the two opposing groups had been quietly buying up the second mortgage bonds.

Shenandoah, Ia.—Shenandoah was to vote at the general election, November 7, on the question of a municipal light, heat and power plant. The proposition was ordered to be submitted to the voters after a petition had been submitted to the council, containing fifty signatures from each of the wards.

Ada Water, Heat & Light Co., Ada, O., which served notice on its patrons several weeks ago that it would discontinue service on October 1 under the existing contract rates, because the company was not making a profit on its operations and had not declared a dividend during an extended period, has been directed by the Court of Common Pleas to continue its service. The decision was the result of an injunction suit brought against the Ada company by several of its customers. Motion to vacate the injunction was overruled by the court.

Webster

AIR CONDITIONING APPARATUS

WEBSTER Air Washer and Air Conditioning Apparatus is constantly demonstrating its ability, under a wide variety of exacting conditions, to effect and maintain any desired temperature or humidity.

Whenever a highly efficient and thoroughly dependable air washing, air cooling or air conditioning system is required, WEBSTER Apparatus, by reason of its exclusive advantages, is selected by engineers, architects and owners.

No air conditioning problem is too difficult for us to solve. Our air conditioning engineering staff is second to none in existence. Give us the opportunity to prove this by taking up your next air conditioning problems with us.

We guarantee results in any problem we undertake.

Write us Today for Catalogue A-37.

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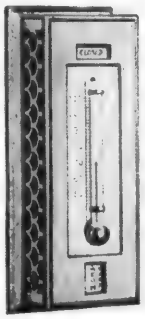
Established 1888. Branch Offices in Principal Cities

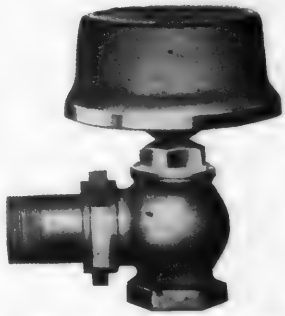
First in the Field



The marvelous little fool-proof thermostat

Automatic temperature control for buildings originated with the **Johnson System of Temperature Regulation.**

While various imitations in the way of regulating devices have been offered to the heating trade, the JOHNSON SYSTEM is the recognized standard.



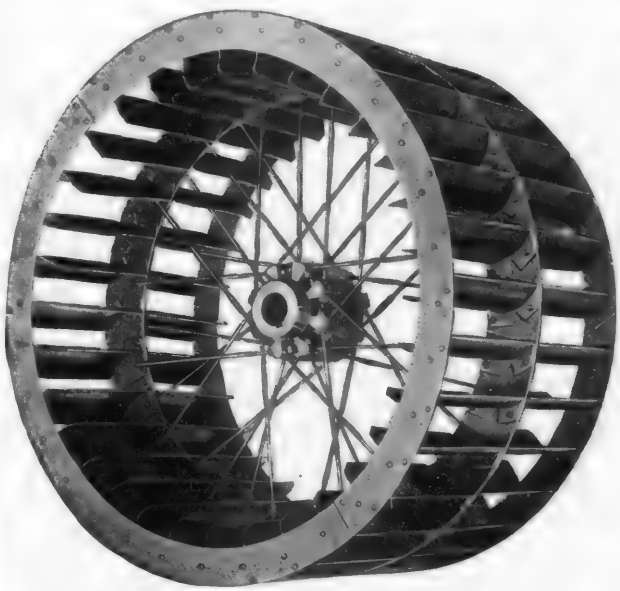
The indestructible sylphon metal diaphragm valve

It costs no more to install the JOHNSON SYSTEM than inferior products, so why assume any risks?

Communicate with our nearest branch in regard to your temperature regulation requirements. Our co-operation is yours for the asking. You can reach us overnight.

The Johnson Service Company

Milwaukee, Wis.



For Heating, Ventilating, Drying and Mechanical Draft Purposes use the

PLEXIFORM FAN

because of its high efficiency, great strength, lightness and low cost of installation.

Plexiform wheel construction is as adaptable for double width as for single width fans, and is the **only type** of **multiple blade wheel fan** that is **equally adaptable** for **high** or **low pressures without change in design and construction.**

We have Fans of **standard Plexiform construction** handling air at —50 deg. and gases at 1000 deg. temperature.

Write for catalogs.

BAYLEY MANUFACTURING CO., Milwaukee, Wis.

Tacoma District Heating Co., Tacoma, Wash., has been incorporated, with a capital stock of $100,000, by A. J. Pritchard, Herbert S. Griggs and Edward Fogg, all of Tacoma. The city council has transferred to the new company the 25-year franchise granted some time ago to Seattle interests. The transfer took place after the Seattle interests had allowed the franchise to lapse. It is stated that a plant costing $50,000 will be built at once and connections made to the department stores and other downtown buildings in Tacoma. The construction of the new plant, it is estimated, will divert more than $20,000 of the present lighting business to the municipal plant of Tacoma.

Lansing, Mich.—Two plans to heat the new and old high school buildings and the library building have been proposed by the Michigan Power Company. One is that the present high school building shall be heated by the Michigan Power Company, with the provision that the company be empowered to use the plant in the high school if it is unable to furnish sufficient steam through its present main to heat the buildings. The other plan provides for the laying of a large main direct from the plant to the high school building, which would furnish enough steam to heat the entire high school and library. The matter was taken under consideration by a committee of the board of education.

Iowa River Light & Power Co., Eldora, Ia., is making extensive improvements to its heating plant in Eldora, extending its steam mains to different sections of the city. This work, costing $30,000, is being done by the American District Heating Co., North Tonawanda, N. Y. D. D. Hayward is the designing engineer and W. P. Currie is supervising the installation. In addition to these improvements the company has expended about $25,000 in rebuilding its steam plant and for the installation of new machinery. In addition to its heating business in Eldora, the company furnishes electricity to eleven other towns.

Coeur d'Alene, Idaho.—The map and plans of the Central Heating and Lighting Company shows that the new firm contemplates the construction at the start of 5,740 lin. ft. of pipe lines to distribute heat from its plant which will be located on Front Street, between Third and Fourth Streets. This construction will be the first portion to be completed by the company, and if the complete plans are carried out it will be added to by an even larger amount of mains. The map is in the hands of Frank D. Warn and J. T. Faulkner, of Coeur d'Alene, both of whom are directors of the company.

Peoria, Ill.—The first of a series of quarterly meetings of superintendents of Hodenpyl, Hardy & Co.'s plants in Michigan, Indiana, Illinois and Ohio, was held in Peoria

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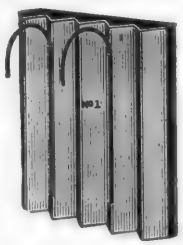

Can be placed on the back of any radiator, out of sight and will supply the desired amount of moisture to any steam or hot water heated room. Especially adapted for houses, offices, schools and hospitals.

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We make a specialty of hot water and steam indicators
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September 5. Papers were read on "The Importance of a Heating Company Co-operating with Its Customers in the Regulation of Their Service," by R. V. Stureman, of the Springfield (Ill.) Gas & Electric Co., and on "Methods of Securing New Steam Heating Business," by J. A. Strawn, of the Central Illinois Light Co., Peoria.

Manufacturers' Notes.

Clarage Fan Co., Kalamazoo, Mich, has established a branch office in Chicago, at 123 West Madison Street. L. O. Monroe is in charge. Mr. Monroe has had several years' experience in the fan business, both in the construction and experimental department in the plant and as a salesman. Attention is called to the fact that Kalamazoo is only 140 miles from Chicago, making direct shipment and prompt delivery possible on all classes of fan apparatus.

Sarco Co., Inc., New York, has recently been successful in obtaining contracts for the supply of radiator traps for several buildings in Detroit, Mich., including the Detroit Evening News Building, the Lavard Hotel and the National Bank of Commerce Building.

H. W. Johns-Manville Co., New York, manufacturer of asbestos products, has opened a new branch office in Great Falls, Montana, in the Ford Building. This increases the number of the company's branches to fifty-five. The office is in charge of J. H. Roe. Great Falls has a population of 38,000, and is one of the greatest hydro power centers in the country.

Richardson & Boynton Co., New York, manufacturer of the Richardson line of boilers, has opened a branch office in Rochester, N. Y. The new office is located in the Cutler Building and the manager is Willis J. Roys.

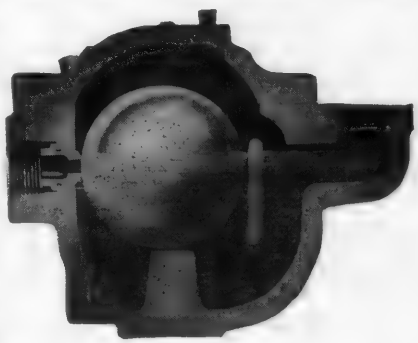
Roys Heat Control Co., Brooklyn, N. Y., manufacturer of the Roys patented heat controller, announces that hereafter its Eastern sales will be handled by the Pierce, Butler & Pierce Mfg. Corporation and its Western sales by the Federal Radiator Co., New Castle, Pa.

J. L. Mott Iron Works, New York, announces that R. K. Bowman has been elected first vice-president and general manager of the company. Mr. Bowman was for many years located at the company's plant in Trenton, N. J.

Holland Furnace Co., Holland, Mich., manufacturer of warm air furnaces, announces a 5% bonus added to each weekly pay check for work done after October 1. In the announcement of the bonus, made by General Manager A. H. Landwehr, he

Air never ties up the J-M Steam Trap

When you consider that air-binding is the most common source of trap trouble, you will appreciate that the J-M Steam Trap is a new and valuable departure—it can't air-bind.



Unlike many traps, the outlet of the J-M Steam Trap is at the water line. As the water rises, the ball is rolled up and an unobstructed outlet is exposed. Air, which is heavier than steam but lighter than water, is discharged with the condensate. As the water level falls, the ball again seals the orifice, preventing escape of steam.

The ball is not connected to any other moving part—there is none. Only three parts make up the J-M Steam Trap—a Body, a Bushing, a Ball—that's all. Ingenious and sound in theory and positive in operation.

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states that "during 1916 we have made material advances in wages, especially for ordinary labor, where no particular trade is required. Our raw materials have also increased greatly in cost, but as we enjoy a very large and growing business and want to have the good will and best efforts of every man who works for us, every factory employee who gives us his best efforts will receive a 5% bonus added to each pay check for work done after October 1." The company is arranging to double the capacity of its plant through the erection of a new foundry 60 x 230 ft. About 100 names will be added to the payroll.

American Blower Co., Detroit, Mich., announces the establishment of a branch office in Salt Lake City, Utah. The new branch is located in the Judge Building and is in charge of H. E. Sproull, formerly manager of the company's Dallas, Texas, branch. The Salt Lake City branch will cover the business houses and mining interests of the inter-mountain territory and in addition to handling the company's line of Sirocco apparatus, will have an engineering staff at the disposal of its clients.

Business Changes.

Hauxwell & Smith, Portchester, N. Y., heating contractors, have purchased the building at 14-16 Broad Street, which they will occupy. The building has a frontage of 60 ft. and a depth of 175 ft.

New Incorporations.

Union Plumbing & Heating Supply Co., Boston, Mass., capital $10,000. Incorporators: George W. Ravin, Samuel H. Harris and Samuel J. Karp.

Central Heating & Lighting Co., Coeur d'Alene, Idaho, capital $100,000. Incorporators: Frank D. Warn, John T. Faulkner, of Coeur d'Alene, and John F. Davis, Spokane.

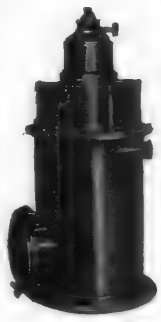
Hoffman Heating Co., St. Louis, Mo., capital $2,000. Incorporators: John Grass, Fred Schmidt and Fred E. Harris.

G. A. Gallivan Co., Munice, Ind., capital $40,000, to conduct a heating and plumbing business. Incorporators: J. A. Gallivan, N. T. Gallivan and Leo F. Canning.

Smith Heating and Ventilating Co., Worcester, Mass., capital $10,000. Incorporators: Nicholas J. Smith, Gertrude A. Quinn and Hervey L. Woodward.

Taylor Steam Specialty Co., Battle Creek, Mich., capital $20,000, to manufacture steam traps and heating apparatus. Officers: President, J. W. Emmerson; vice-president, J. C. Bryce; secretary, John H. Taylor; treasurer, J. M. Taylor.

U. B. Light, Heat & Power Co., Dayton, O., capital $10,000. Incorporators: A. W.



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A PUMP FOR EVERY PURPOSE

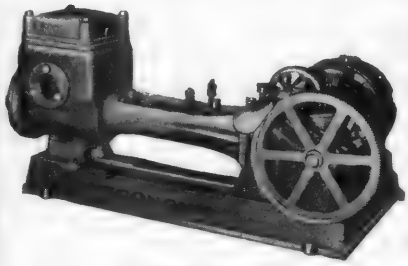

Figure 2149
Economy Motor Driven, Direct Acting Vacuum Pump, Double Acting Type

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- Automatic Condensation Pumps and Receivers
- Vacuum Pumps, for two pipe or air line systems—automatic, electric or hand control
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Figure 2129—Economy Automatic Condensation Pump and Receiver for low water lines and underground returns.

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Electric Heat Blower

is just the thing for that small room or hall that does not require a large heating unit and which is used only occasionally.

The Sturtevant set consists of a motor-driven fan discharging air through heating coils placed in an aluminum casing.
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UNITED VACUUM APPLIANCE CO.
CONNERSVILLE, INDIANA

Drury, H. C. Crindland, W. R. Funk, R. C. Kumler and F. A. Z. Kumler.

O. F. Kraus Co., New Britain, Conn., capital $25,000, to conduct a heating and plumbing business. Incorporators: Oscar F. Kraus, Frank Urban and Matthew McGrath.

Cleary & Russell, Inc., Red Bank, N. J., capital $2,000, to conduct a heating, plumbing and roofing business. Incorporators: Michael J. Russell, Thomas J. Cleary and James W. Russell.

Tuec-Troop Co., Cincinnati, O., capital $10,000, to act as sales agents in Cincinnati territory for the Tuec stationary vacuum cleaners, Troop automatic gas water heaters, and Hill Canton laundry dryers. Incorporators: Grace F. Baumgardner, Edward Ortiger, Edward J. Baumgardner, Charles J. Ruehrwein and Charles A. Hafner.

Thompson Heating Co., Columbus, O., capital $10,000, to manufacture patented gas furnace invented by R. S. Thompson. Incorporators: R. S. Thompson, H. S. Haslett, T. D. Bendure, Edwin F. Willis and Clarence L. Corkwell.

Contracts Awarded.

Cook & McDonnell, Oklahoma City, Okla., heating and ventilating new high school building in Tulsa, Okla.; also heating, ventilating and plumbing Central High School, Oklahoma City, for $64,000.

G. E. Newton Co., Waterloo, Ia., heating and ventilating new school in Jesup for $10,500.

A. C. Eynon Plumbing Co., Canton, O., heating and ventilating front and right wings of the new high school building in Canton for $56,743.14. Other bids were as follows: F. E. Geisler & Co., Pittsburgh, Pa., $58,750; Chapman Plumbing & Supply Co., Canton, O., $86,298.

Hough & Co., Los Angeles, Calif., heating gymnasium and clubhouse of the Elks Lodge in Los Angeles.

Child & Scott Co., New York, remodeling heating and ventilating system in the Engineering Societies Building, New York.

John J. Nesbitt, Philadelphia, Pa., heating and ventilating new high school in Camden, N. J., for $72,500.

Appling-Gripps Co., Portland, Ore., heating and ventilating Benson Polytechnic School in Portland, for $39,409. Other bids were: J. F. Shea, Portland, $42,386; Rushlight & Hastorf, Portland, $48,705; Kendall Heating Co., Portland, $44,355.

American Heating & Ventilating Co., Toledo, O., heating and ventilating pro-

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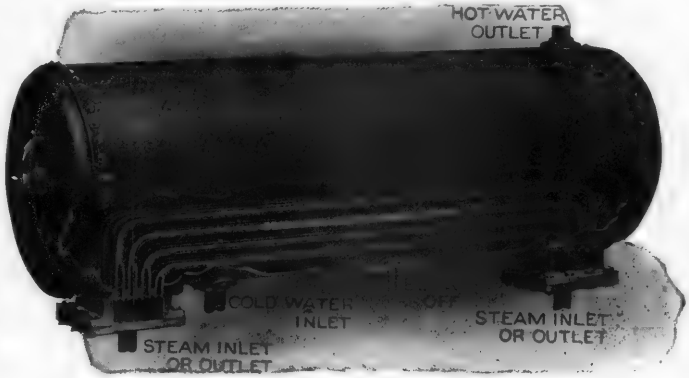

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DISTRICT HEATING. By S. Morgan Bushnell and Fred. B. Orr. This book not only imparts a general knowledge of district heating, but contains many points on economical operation, as illustrated in the methods practiced by central station heating companies which have been successful in this field. Comparative data are also presented indicating the prices that can reasonably be charged for heating service. Size 6 x 9 in. 300 pages. 81 figs. Cloth, $3.00.

CENTRAL STATION HEATING. By Byron T. Gifford. This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used. 208 pages, with 42 figures, including 50 pages of miscellaneous engineering data. Size 6x9½ in., bound in flexible leather. Price, $4.00.

MECHANICAL EQUIPMENT OF FEDERAL BUILDINGS. By Nelson S. Thompson. Third revised edition, covering the basic data used by the Treasury Department in the design of the entire mechanical equipment of Federal Buildings under its control. Includes data on heating and ventilating, plumbing, drainage and water supply systems, gas piping, conduit and wiring systems, lighting fixtures, elevators, small power plants, motors and controlling apparatus, vacuum cleaning systems, operating data, etc. Size 6x9 in. 400 pages. Cloth, $3.00.

VACUUM CLEANING SYSTEMS. By Maxwell S. Cooley. A reliable data book for engineers, architects, heating contractors and plumbers interested in the correct design and installation of mechanical cleaning plants. Size 6 x 9 in. 244 pages. 105 ills. 20 tables. Price, $3.00 postpaid.

VENTILATING DUCTS. By C. E. Pearce. A set of six tables printed on heavy Bristol board, for rapidly estimating the superficial area and weights of galvanized iron rectangular ducts used in ventilating work. Size 7 x 9 in. Price, 50 cents.

ELEMENTS OF HEATING AND VENTILATION. By Arthur M. Greene, Jr. A text book for technical students and a reference book for engineers. 330 pages. Size 6 x 9½ in. 223 ills. Price, $2 50 postpaid.

MECHANICS OF HEATING AND VENTILATING. By Konrad Meier. Including a series of ten charts containing data relating to the flow of water, steam and air, collected by Mr. Meier during an experience of 26 years in heating and ventilating work, both in this country and abroad. Each of the charts replaces a series of tables on the subject, giving at a glance the result of a calculation from any combination of factors. 161 pages, illustrated, with ten large charts. Size 6 x 9 in. Price, $5.00. Separate sets of charts, printed on cloth, with lines in different colors and mounted on boards. Single charts, $1.50. Sets of ten charts, $15.00.

HEATING AND VENTILATING BUILDINGS, a standard manual for heating engineers and architects. By Prof. R. C. Carpenter. Sixth edition, largely rewritten. 577 pages, 277 illustrations, 8vo, cloth, $3.50.

HANDBOOK FOR HEATING AND VENTILATING ENGINEERS. By Prof. James D. Hoffman and Benjamin F. Raber. The latest book on this subject. Unusually comprehensive. 320 pages, with 45-page appendix. Size 4½ x 6¾ in., bound in flexible leather. Price, $3.50.

PRACTICAL MANUAL OF STEAM AND HOT WATER HEATING. By E. R. Pierce. Especially useful to men engaged in installing steam and hot water heating apparatus. Easily understood and comprehensive. Boiler ratings exhaustively treated. 359 pages. Size 5⅛ x 8⅛ in. Cloth, $2.50.

PROGRESSIVE FURNACE HEATING. By Alfred G. King. A practical manual of designing, estimating and installing modern systems for heating and ventilating buildings with warm air. Written especially for contractors and mechanics. Size 6 x 9 in. 280 pages. 189 illustrations. Price, $2,50 postpaid.

PIPE FITTING CHARTS. By William G. Snow. A valuable reference work for the solution of knotty problems in connecting up steam radiators, boilers and the variety of appliances used in combination high and low pressure plants. 285 pages. 232 illustrations. Price, $2.00.

STEAM POWER PLANTS; Their Design and Construction. By Henry C. Meyer, Fr., M. E. Third edition, fully revised. One of the standard works on the design and construction of power plants. Covers proportioning boilers, selection and writing specifications for steam engines, selection and arrangement of auxiliaries, construction of chimneys, coal handling, etc. 219 pages. Size 6 x 9 in. Illustrated and with folding plates. Price, $2.00 postpaid.

DESIGNING HEATING AND VENTILATING SYSTEMS. By Charles A. Fuller. A textbook which treats both the theoretical and practical side of the subject in a simple, but clear and comprehensive manner. Instruction given covering the design any kind of heating or ventilating system. 224 pages. Size 6 x 9 in. 78 figs. and 37 tables. Cloth, $2.00.

PRACTICAL STEAM AND HOT WATER HEATING. By Alfred G. King. Containing over 300 detailed illustrations. The book is a working manual for heating contractors, journeymen steam fitters, architects and builders. Describes various systems of heating and ventilation and includes useful data and tables for estimating, installing and testing such systems. 8vo. 367 pages. Price, $3.00.

POWER, HEATING AND VENTILATION. By Charles L. Hubbard, BS., M.E. A treatise for designing and constructing engineers and architects. The whole subject of heating is covered, including the heating of large institutions with central plants. Space is also devoted to electrical matters connected with steam plants. 1015 pages. Vol. 1 (Steam Power Plants), $2.50; Vol. 2 (Heating and Ventilating Plants), $2.50; Vol. 3 (Combined Power and Heating Plants), $3.00. Sold separately.

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THE PRINCIPLES OF HEATING. By William G. Snow. A practical and comprehensive treatise on Applied Theory in Heating. 161 pages. 42 illustrations. 38 tables. Size 6 x 9 in. Cloth, $2.00.

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posed new high school in Covington, Ky., for $31,925.

Almirall & Co., New York, Heating $450,000 plant at Tompkinsville, L. I., for the Louis De Jonge Company.

Wheeler-Blaney Co., Kalamazoo, Mich., heating and plumbing new city hospital at Jackson, Mich., for $35,000.

E. J. Claffey Co., Chicago, Ill., heating new ten-story Parkway Hotel at Garfield Avenue and Lincoln Parkway, Chicago.

Thomas Heating Co., Racine, Wis., was the low bidder, at $10,897, for the heating and ventilating of the new high school building in Berlin, Wis. Other bids were: Paul E. Mueller Co., Milwaukee, $11,376; L. W. Dunkerschien Heating and Ventilating Co., Oshkosh, $11,788; W. S. Patterson Co., Appleton, $11,992; F. F. McNichol & Co., Oshkosh, $12,115.

Otto A. Wurm Co., Detroit, Mich., heating and ventilating addition to Hazleton School for $11,400.

Somerville, Mass.—Bids were received as follows for the heating and ventilation of the new junior high school building in Somerville: Lingley-Holloway Co., $10,925 and $13,530; P. J. Sullivan, $10,837 and $13,098; Pierce & Cox, $11,211 and $13,746; Huey Bros. Co., $10,787 and $12,987; T. A. Ridder Co., $11,688 and $14,328; F. W. Zeimer & Co., $11,274 and $14,104; H. E. Whitten, $11,041 and $14,231; P. E. Carrigan, $10,872 and $12,187; J. J. Hurley, $10,274 and $13,574; W. B. Brown & Co., $13,037 and $15,190; Bay State Heating Co., $11,994 and $14,956.

Robert Inskip, Wallace, Idaho, heating and plumbing new Isolation Hospital near Wallace. Heating contract, $10,321; plumbing, $10,589.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following named work:

Until November 10, 1916, for the construction complete of the U. S. Post Office at Wenatchee, Wash.

Until November 14, 1916, for the construction of the U. S. Post Office at Media, Pa.

Until November 20, 1916, for the construction complete, of the U. S. Post Office at Yoakum, Tex.

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The ventilating equipment in

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Pittsburgh's Finest High School

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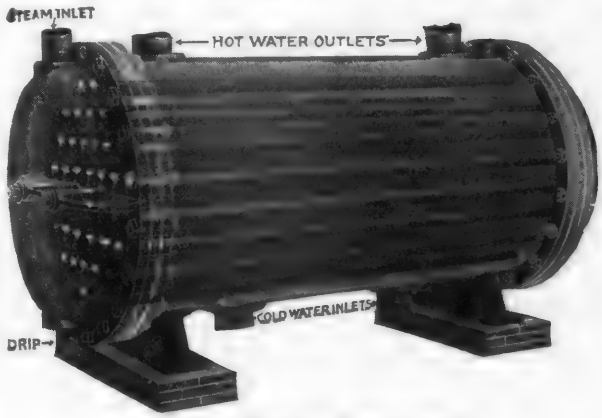

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Shell of heaters made of cast iron, eliminating the possibility of pitting—so common where steel is used.

Heating surface consists of highest grade seamless brass tubing, the ends being properly packed to provide for expansion.

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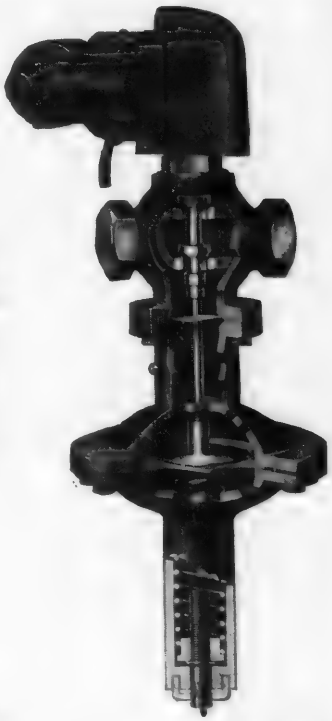

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Until November 27, 1916, for the construction of the U. S. Post Office at East Orange, N. J.

Until December 6, 1916, for the construction complete of the U. S. Post Office at Twin Falls, Idaho.

Until December 7, 1916, for the construction of the U. S. Post Office and Court House at Chadron, Neb.

Until December 22, 1916, for the extension and remodeling, including mechanical equipment and approaches, of the U. S. Post Office and Court House at East St. Louis, Ill.

New York State Industrial Safety Congress.

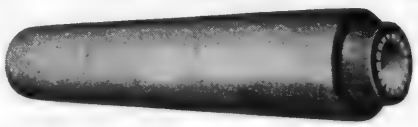
An industrial safety congress has been arranged by the Industrial Commission of New York State, to be held in Syracuse, December 11-14, 1916. The sessions will be held at the Hotel Onondaga. Experts on fire prevention, factory sanitation, safeguarding of machinery, and on other factors entering into industrial safety will be among the speakers. Illustrated lectures by the National Safety Council and the American Museum of Safety will furnish the evening features.

One of the sessions will be given over to a discussion of "Factory Lighting, Heating and Ventilation."

National Building Exposition in New York.

New York has been chosen as the place for holding the next "National Complete Building Exposition," the dates being March 5-11, 1917. The exposition will be held in the Grand Central Palace. This will be the second exposition of its kind, the first having been held in Cleveland, O., last February and backed only by local interests. Intended to educate the man-about-to-build, its promoters quickly learned that its first task was to educate the manufacturer and building supply dealer to the wisdom of exhibiting their wares. The New York exposition, it is stated, while giving quite as much attention to the home building feature, will be broader and more comprehensive in its scope, dealing with the problems of the public and commercial buildings. The offices of the exposition are in the Cuyahoga Building, Cleveland, O.

STANDARD
Steam Pipe Casing



For Insulating Underground Steam Pipe. Tin Lined, or Unlined.

Every salesman has his argument in order to sell the product he represents. Listen to our argument, be the judge, and you will find same not theoretical but practical, and from actual experience.

When you cover your steam line with our make of casing you have the assurance that the line will be constructed so that no heat will escape, and will be water tight as well, with ample space for air chamber.

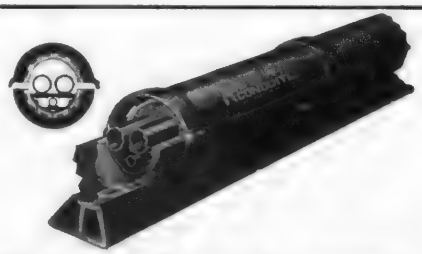
Should occasion arise that it is necessary to get at the steam pipe, our covering CAN BE TAKEN APART WITHOUT DESTROYING THE STAVES in the sections of casing, and the same casing can be used again. LET US EXPLAIN HOW.

If your line runs in different branches we will build the casing in exact lengths so that you will not have to cut any sections, which means no waste or extra expense to you.

Our method of building covering will be to your interest. Our product is right, attention prompt, and prices low.

SEND FOR BOOKLET

Standard Wood Pipe Co.
WILLIAMSPORT, PA.



"It is decidedly foolish economy"

says Byron T. Gifford in his book on Central Station Heating, "to use inferior material or poor workmanship in anything going under ground to stay as long in service as a heating system **should** stay in service"—and no better argument could have been made for the

RIC-WIL METHOD

of insulating underground heating systems

Besides its highly efficient insulating qualities, Ric-WiL conduit possesses the only perfect underdrainage system.

Write for our booklet "Ric-wiL MethoD."

THE RIC-WIL CO.
623 Guardian Bldg., Cleveland

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The Elasticity of Copper

and

The Strength of Iron

combine to make the

BADGER EXPANSION JOINT

the most efficient fitting obtainable

FOR PIPE EXPANSION

Simply a corrugated copper tube, flanged and reinforced by iron rings which distribute the strain evenly over all the corrugations.

NEVER NEED PACKING. NO CHANCE FOR LEAKS

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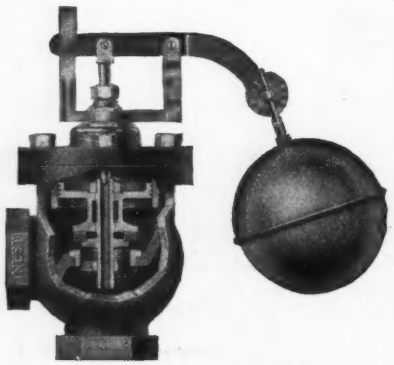
E. B. BADGER & SONS CO.

BOSTON **NEW YORK**

DAVIS VALVES



Davis Float Valve

THE little things that come under your care often give you the greatest annoyance when they go wrong.

You can safely put your faith in a Davis Float Valve. It was designed to operate without trouble and it works as intended.

It has a single seated renewable composition disc—it is tight when closed.

The expense and annoyance of fooling with a leather cup packing is entirely eliminated—only the stem is packed.

Try one of these valves at our risk. Globe and angle patterns.

We make Pressure Regulators, Balanced Valve, Float Valve, Steam Trap, Back Pressure Valve, Exhaust Relief Valves, Stop and Check Valves, Pump Governors, Damper Regulator, Radiator Air Valves, Emergency Stop Valve.

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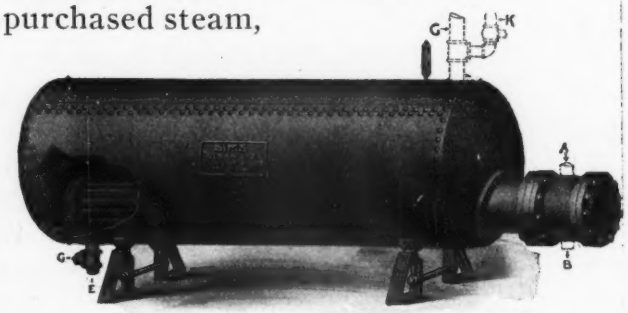
Valve Specialty Manufacturers Since 1875

SIMS HEATERS MAKE EFFICIENT COOLING COILS

For buildings heated with purchased steam, requiring hot water for general service the

Sims Clean E-Z Steam Tube Heater



For utilizing waste heat in condensation from radiators, the tubes are arranged in four or more passes, reducing temperature of condensate to that of water entering tank, heating water for general service to satisfactory temperature.

Gas or coal heater may be connected to tank for summer use.

For particulars write

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Plants requiring removal of water vapor, dust, dirt, etc., from the air as a means of bettering production capacity and promoting cleanliness and good working conditions for operatives will find Carrier Dehumidifying Apparatus capable of making immense savings.

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Carrier Dehumidifying Apparatus is installed to allow the packing of certain of their goods in the humid weather of summer.

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Interior view showing valve open

NORWALL

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NORWALL Siphon Air Valves save adjustment work for your fitters. Being *all* metal, the NORWALL Siphon cannot be "steam cooked" into uselessness like composition post or cylinder construction valves.

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